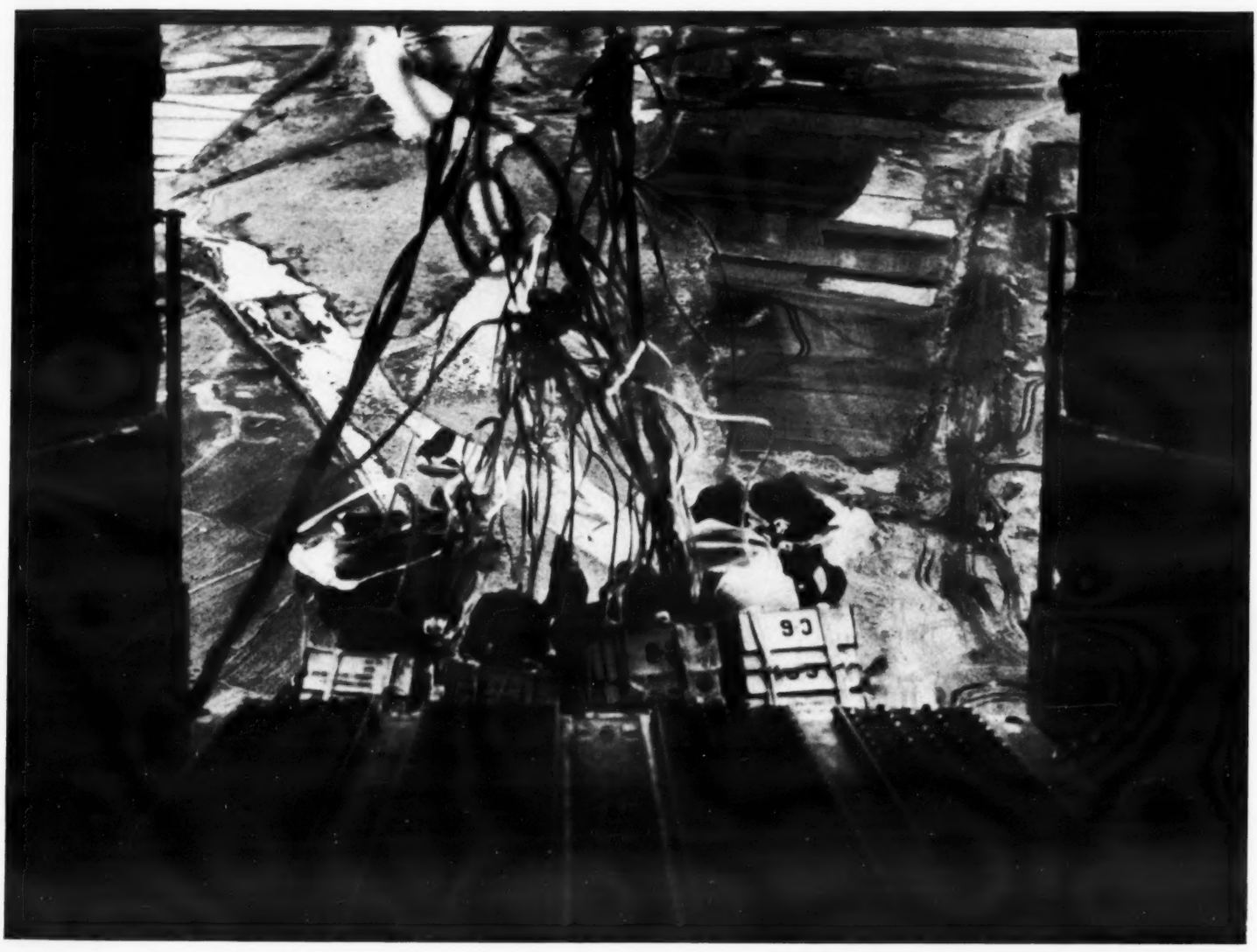
INTERAVIA

REVIEW OF WORLD AVIATION



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"Vertical Warfare"

VOLUME VIII 4 1953

"On Time" Deliveries COUNT — AT CANADAIR

Vignettes of
CANADA—AIR LAND

Fish Planting: The Air Division of Canada's Department of Lands and Forests has recently developed efficient new equipment for this purpose. Consisting of two large aluminum water tanks aerated periodically by a connecting oxygen tank, the fingerlings are released through a funnel fitted into the aircraft's former camera hatch, through which they are dropped from heights of 300 to 500 feet. The Department of Lands and Forests report that 100% of the yearlings survive. Since flying began . . . Canada has been an air-minded nation, and from executive work to prospecting for oil, Canadians continue to make the airways an essential part of their great development.

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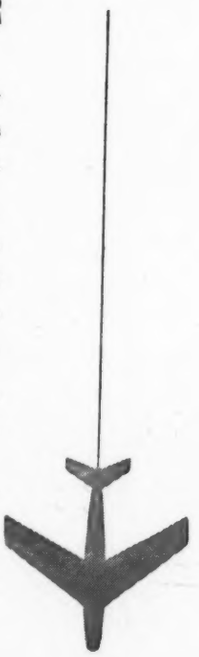

INTERAVIA

Review of World Aviation

Volume VIII — No 4 — 1953

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Front Cover:

Vertical War — five tons of emergency combat supplies spill earthwards in Korea from a Fairchild C-119 "FLYING BOXCAR" of the U. S. Far East Air Force's 314th Troop Carrier Wing.

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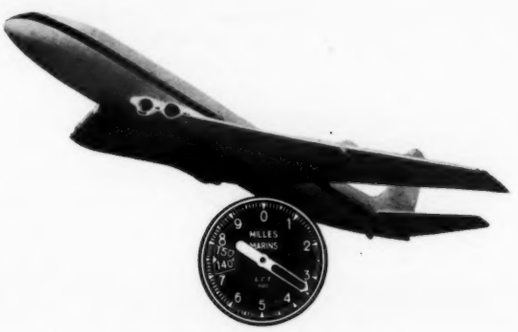
SYSTEM OF NAVIGATION

Azimuth-Distance ρθ

★



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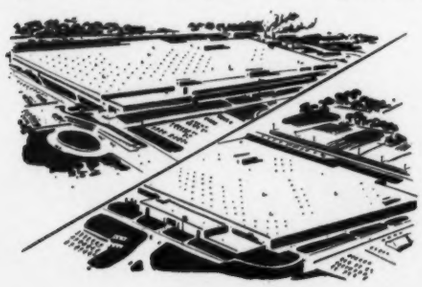
UNITED AIRCRAFT EXPORT CORPORATION

UNITED AIRCRAFT CORPORATION COMPLETES RECORD EXPANSION

In 1952, United Aircraft Corporation completed the major phases of the largest expansion program in its history while maintaining an increasing flow of aviation products to military services and commercial consumers, the Corporation's president, H. Mansfield Horner, reported. All four divisions, Pratt & Whitney Aircraft, Hamilton Standard, Chance Vought Aircraft and Sikorsky Aircraft, put important new designs into production.

TWO NEW FACTORIES BUILT, TWO ENLARGED

Two new factories were built and major expansion of two others was accomplished during the year as part of a privately financed $40,000,000 building program. The Hamilton Standard division occupied a new plant in mid-year. Pratt & Whitney moved part of its engine building work into the factory vacated by Hamilton Standard, and also occupied an additional new plant. The Sikorsky Aircraft division enlarged its facilities by a third. At year's end, more than 1,500,000 square feet of floor space had been added by United's manufacturing divisions, and the corporation had a total employment of over 46,000 persons. This number is expected to rise substantially this year.



PRATT & WHITNEY ENGINE PRODUCTION INCREASED

Pratt & Whitney Aircraft further enlarged the scope of its engine building program in 1952. The big J-57, widely described as the most powerful jet engine now flying in this country, moved from the flight test stage to installation in aircraft designed specifically around it. In April both the Boeing YB-52 and the Convair YB-60 made successful maiden flights, each powered by eight J-57s which maintained their record of high thrust and low fuel consumption. The Air Force also selected the J-57 for use in several of its advanced new fighter planes. Details of this engine are still classified as confidential by the U.S. Government.

The 5,700-horsepower T-34 axial-flow propeller-turbine engine was selected for installation in experimental military transports for the Navy and Air Force. Also in 1952 the division began a program to develop and build ramjet engines to power several types of Navy guided missiles. Along with stepped-up development and production of jet engines, Pratt & Whitney continued production of R-4360 Wasp Major, R-2800 Double Wasp, and the R-2000 Twin Wasp piston engines for military and commercial users.

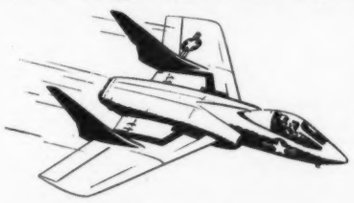
NEW PRODUCTS ADDED BY HAMILTON STANDARD

With twice as much manufacturing space as it had in East Hartford, Hamilton Standard division was able to put added emphasis on its aircraft equipment products and maintain its leading position in the propeller field. Production of a new type hydraulic pump and jet engine starters was begun; output of fuel controls and air-cycle refrigeration units increased. Development of the advanced Turbo-Hydromatic propeller with hollow steel blades continued during the year.

Hamilton Standard's reversing Hydromatic continued to dominate the commercial propeller field. Approximately 30 airlines throughout the world specified these propellers for new aircraft purchased during the year. These planes included Douglas DC-6As and DC-6Bs, Martin 404s, Convair 340s, and France's Breguet 763s. Almost all Lockheed 1049 Constellations and Super Constellations ordered by the airlines during the year will be equipped with 43E60 Hydromatic propellers. This propeller was also selected for 58 Douglas DC-7s ordered by four United States flag airlines. The military services continued to call on Hamilton Standard for propellers in high quantity for a large number of aircraft.

CUTLASS IN PRODUCTION AS CORSAIR OUTPUT ENDS

Chance Vought Aircraft's new Cutlass, the twin-jet F7U-3, passed pre-carrier tests, then went on to pass the initial phases of rugged carrier qualification on the USS Midway. Navy officials recently described the F7U-3 as "better than the Russian Mig." The Cutlass is in the over 650 mile-per-hour class and offers superiority in performance at high altitudes, in range, rate of climb, maneuverability and fire-power.



While the Cutlass emerged as one of this country's potential top weapons, Chance Vought brought to a close production of the famed Corsair of World War II. Two versions of the gull-winged veteran, the AU-1 for the Navy, and the F4U-7 for the French government under the Mutual Defense Assistance Program, were the last of the famous type to be built. The Corsair, powered by Pratt & Whitney R-2800 engines and equipped with Hamilton Standard propellers, is still in regular service in Korea.

SIKORSKY HELICOPTERS HAVE RECORD YEAR

The Sikorsky Aircraft division, the leader in the helicopter field, continued high production in 1952 of the S-55 type, which was in daily use by the Air Force, Navy, Marines, Coast Guard, and several airlines. In August, two S-55s, operated by the Air Rescue Service of the Military Air Transport Service, completed the first transatlantic helicopter flight in history. In Korea, Sikorsky four-place S-51s and the larger S-55 types carried out thousands of rescues, many of them behind enemy lines. They have evacuated more than 10,000 wounded from the front lines and carried out many other combat missions.

Commercial applications of the versatile Sikorsky helicopters increased during the year, with big S-55s being used in a variety of jobs throughout the world.

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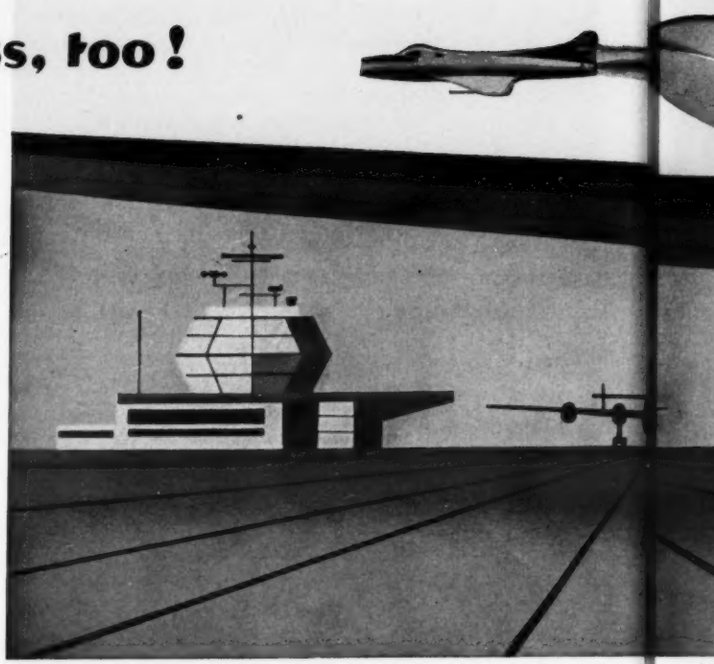

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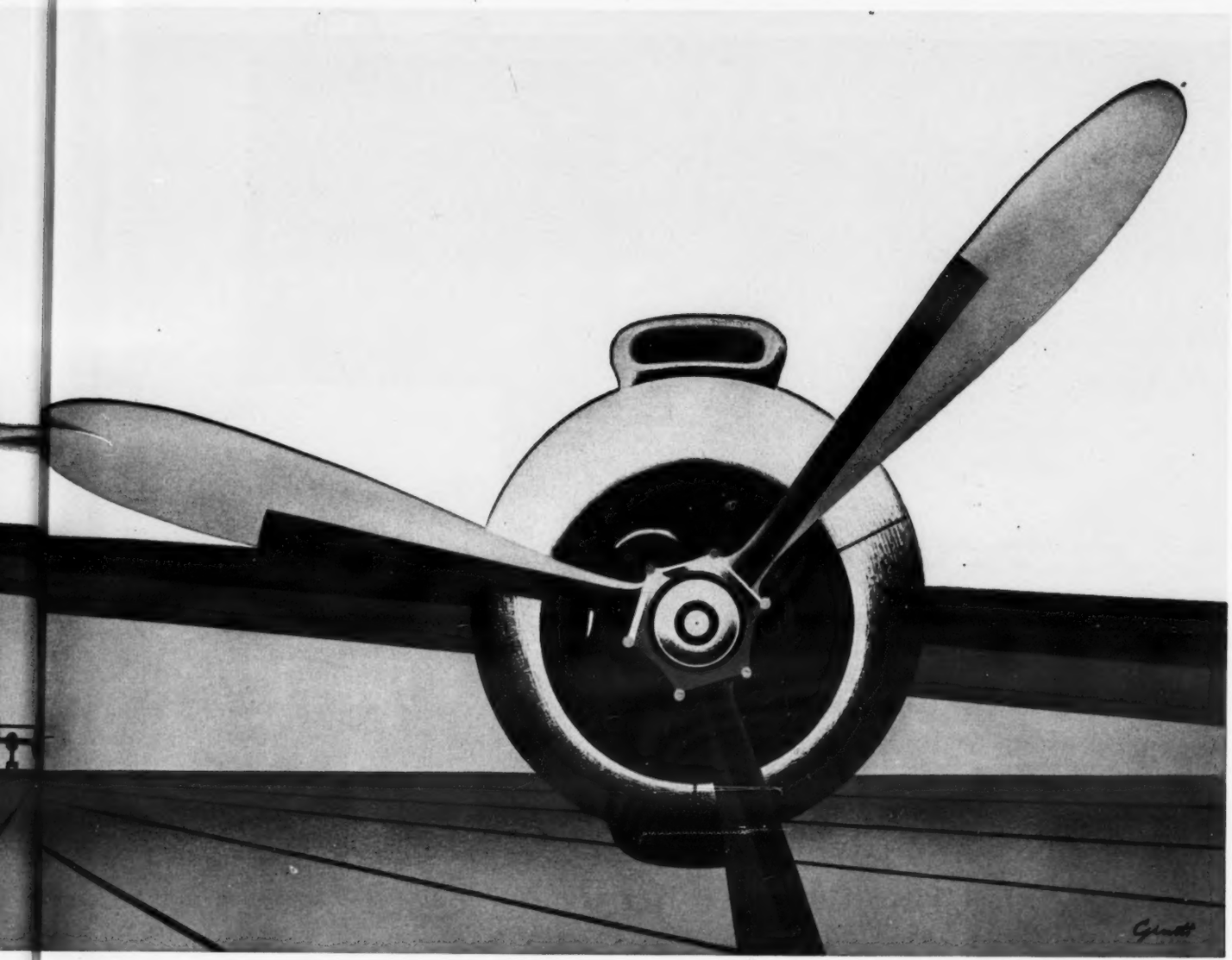

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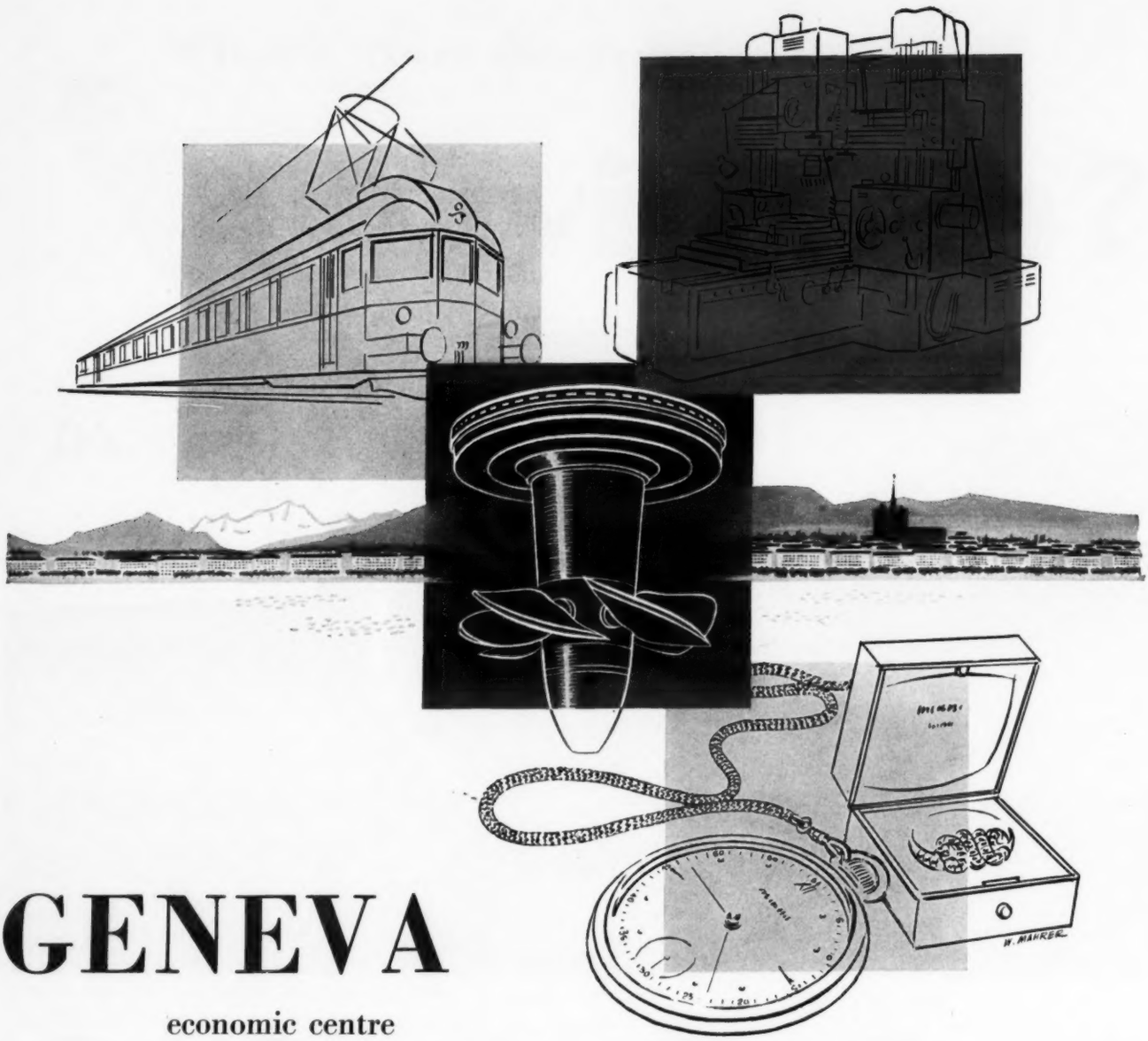

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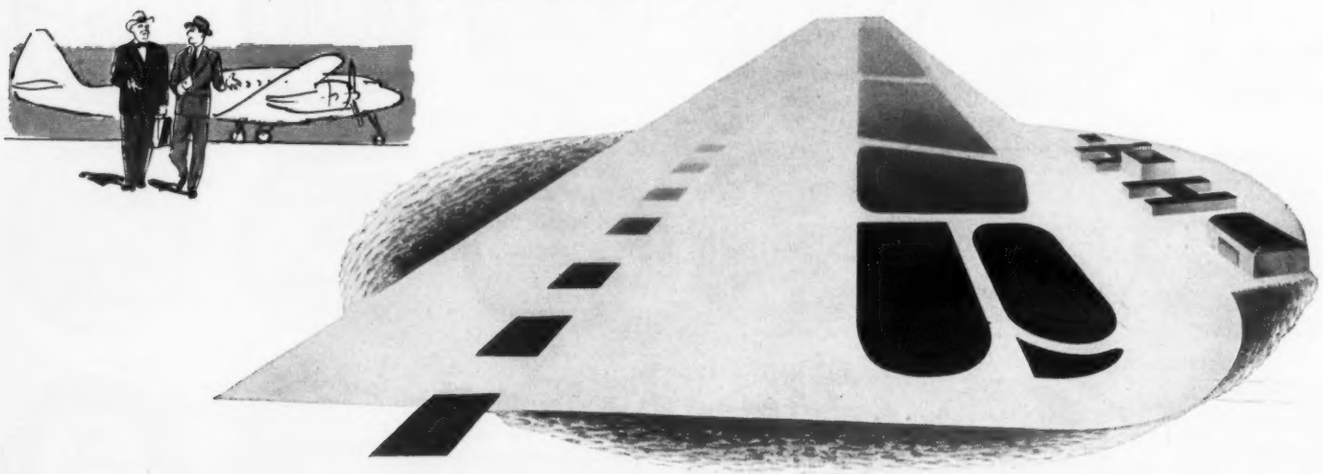

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RADIONAVIGATION ET RADIOCOMMUNICATIONS

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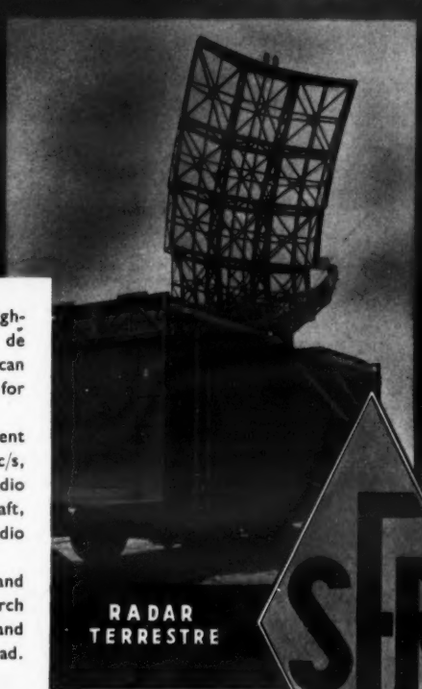

RADAR
TERRESTRE

Thanks to their 30 years' research in high-frequency problems, Compagnie Générale de TSF and Société Française Radioélectrique can now produce high-quality radar equipment for all uses.

Then there is the CSF Type ASV 23 instrument landing equipment, which works on 1200 mc/s, the SFR radio navigation instruments (radio altimeters, VHF D/F equipment for aircraft, airports, etc.) and a whole range of radio communications equipment.

CSF and SFR instruments, developed and tested in large specialized electronic research laboratories, are widely used by civil and military authorities, both in France and abroad.

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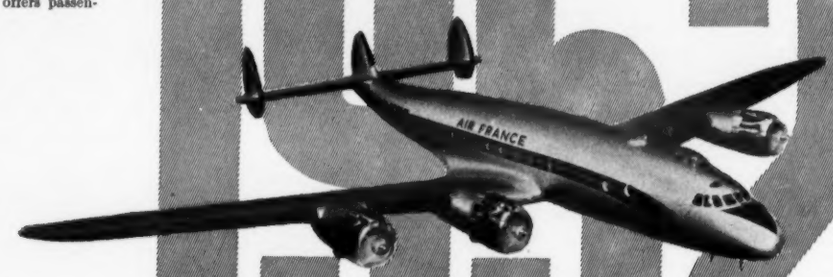
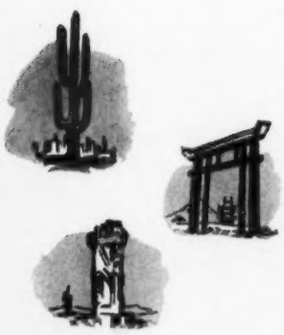
PUBL. RAPY

With each succeeding year Air France is consolidating its position on the world market through its constantly expanding route network, its high standard of maintenance, the comfort and service it offers passengers.

1952



A constructive year, as the following facts show



The opening of several new routes brought the Air France network up to 235,000 kilometres.

APRIL :	Opening of the Paris-Mexico City service.
NOVEMBER :	Mulhouse-Marseilles-Algiers service. Paris-Tokyo service by Constellation in a flying time of 37 hrs. 30 mins.
DECEMBER :	Installation of sky lounge chairs on one of the Paris-Casablanca services. New luxury service to Dakar.
JANUARY 1953 :	Opening of Paris-Caracas-Bogota service.

Air France is doing its utmost to bring the aircraft within the reach of all :
— " tourist class " has been introduced on some routes.
— major reductions have been agreed to on others.

A FEW EXAMPLES :

SECOND CLASS :	Paris-Algiers return	30,150 frs
	Paris-Casablanca return	43,290 frs
NIGHT RATE:	Paris-London return	9,560 frs

To fly to Rome you pay only 26,950 frs. (return valid 8 days).
To go to America costs only 158,550 frs. (return, tourist class).

Air France has a powerful organization to serve you.
Why not make it your first choice among airlines?

AIR FRANCE

IN BOTH TECHNICAL AND COMMERCIAL FIELDS AIR FRANCE "QUALITY" IS KNOWN THROUGHOUT THE WORLD

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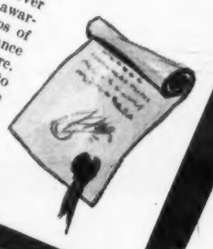

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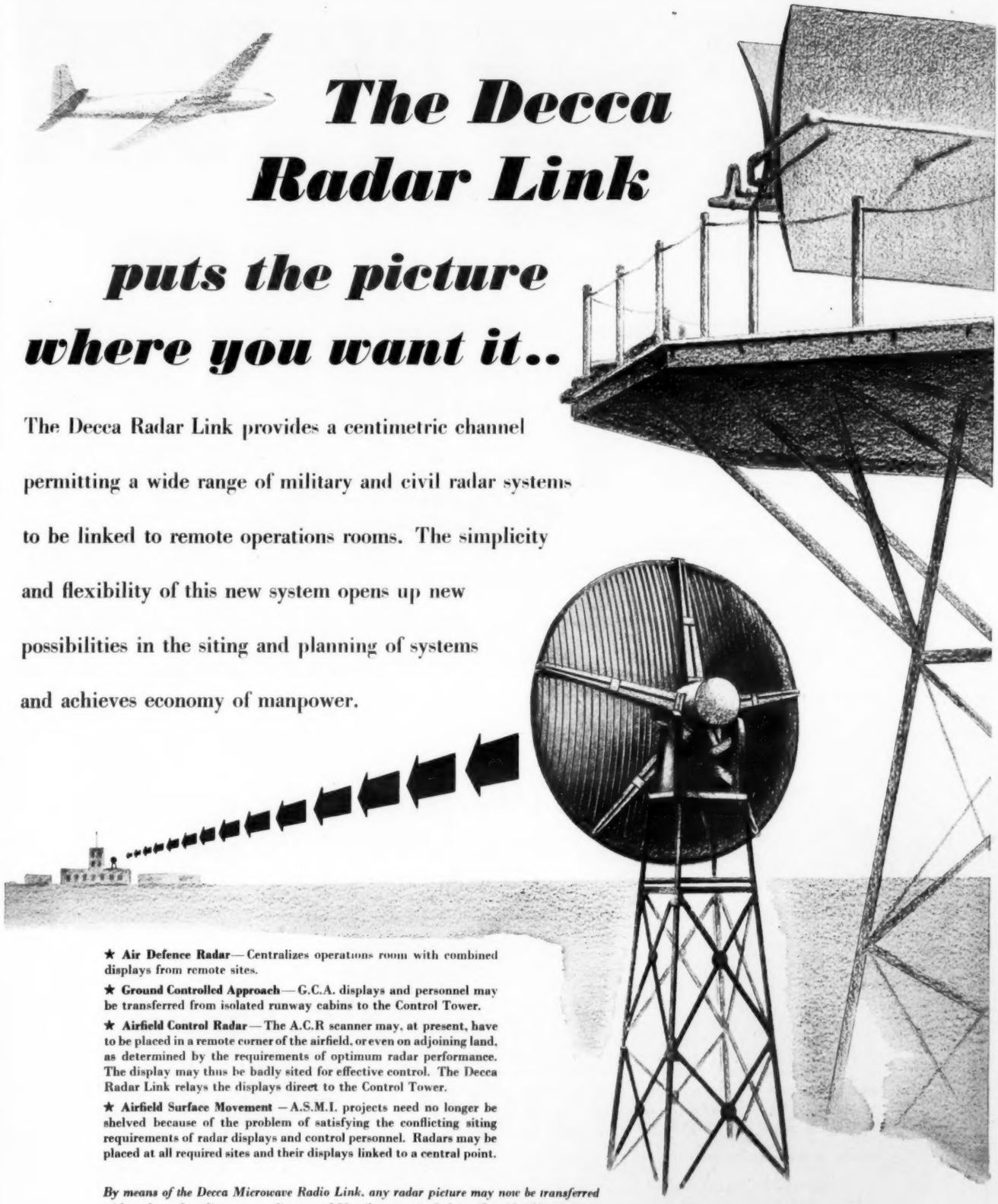

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★ **Airfield Control Radar**—The A.C.R scanner may, at present, have to be placed in a remote corner of the airfield, or even on adjoining land, as determined by the requirements of optimum radar performance. The display may thus be badly sited for effective control. The Decca Radar Link relays the displays direct to the Control Tower.

★ **Airfield Surface Movement**—A.S.M.I. projects need no longer be shelved because of the problem of satisfying the conflicting siting requirements of radar displays and control personnel. Radars may be placed at all required sites and their displays linked to a central point.

By means of the Decca Microwave Radio Link, any radar picture may now be transferred without loss of quality up to a distance of 20 miles at a single hop. Considerably greater distances are obtainable with the Decca Link Repeater.

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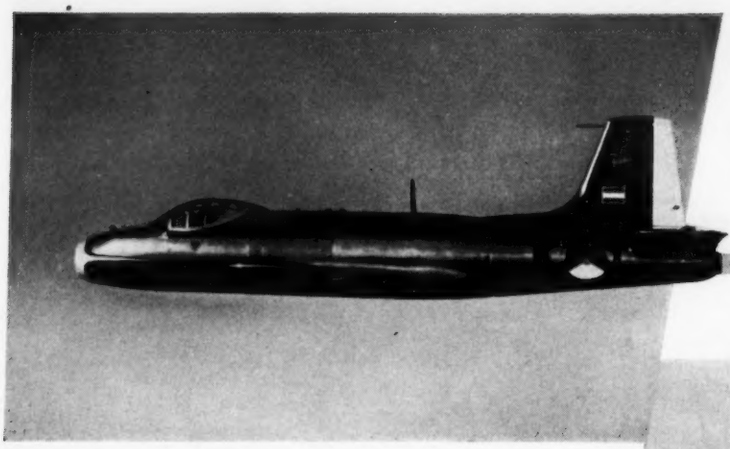

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WITH SIDE BY SIDE EJECTION SEATS

Gen. I. A. Aler, C.o.S. Dutch Air Force in an interview:

...All over the world it will be necessary to admit the fact that young pilots need good jet trainers. At the moment we have them not yet at our disposal.

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However, a jet trainer does exist.

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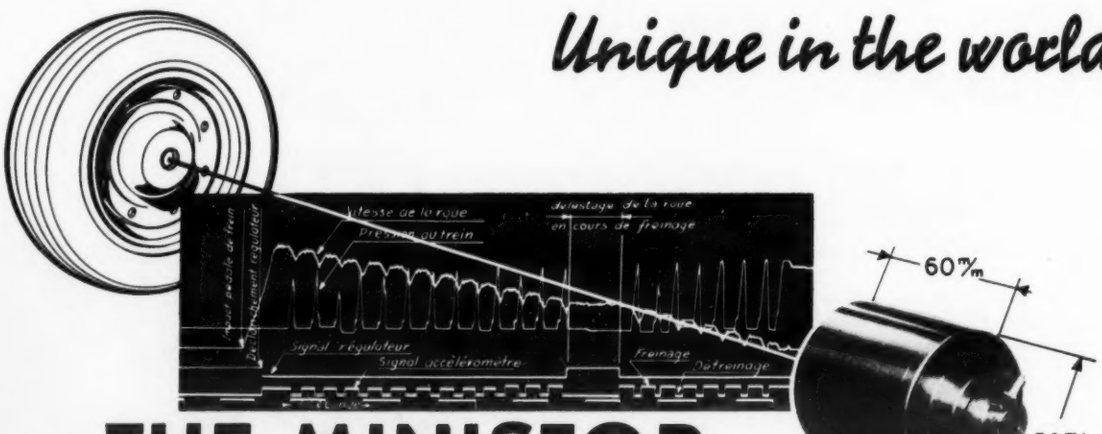

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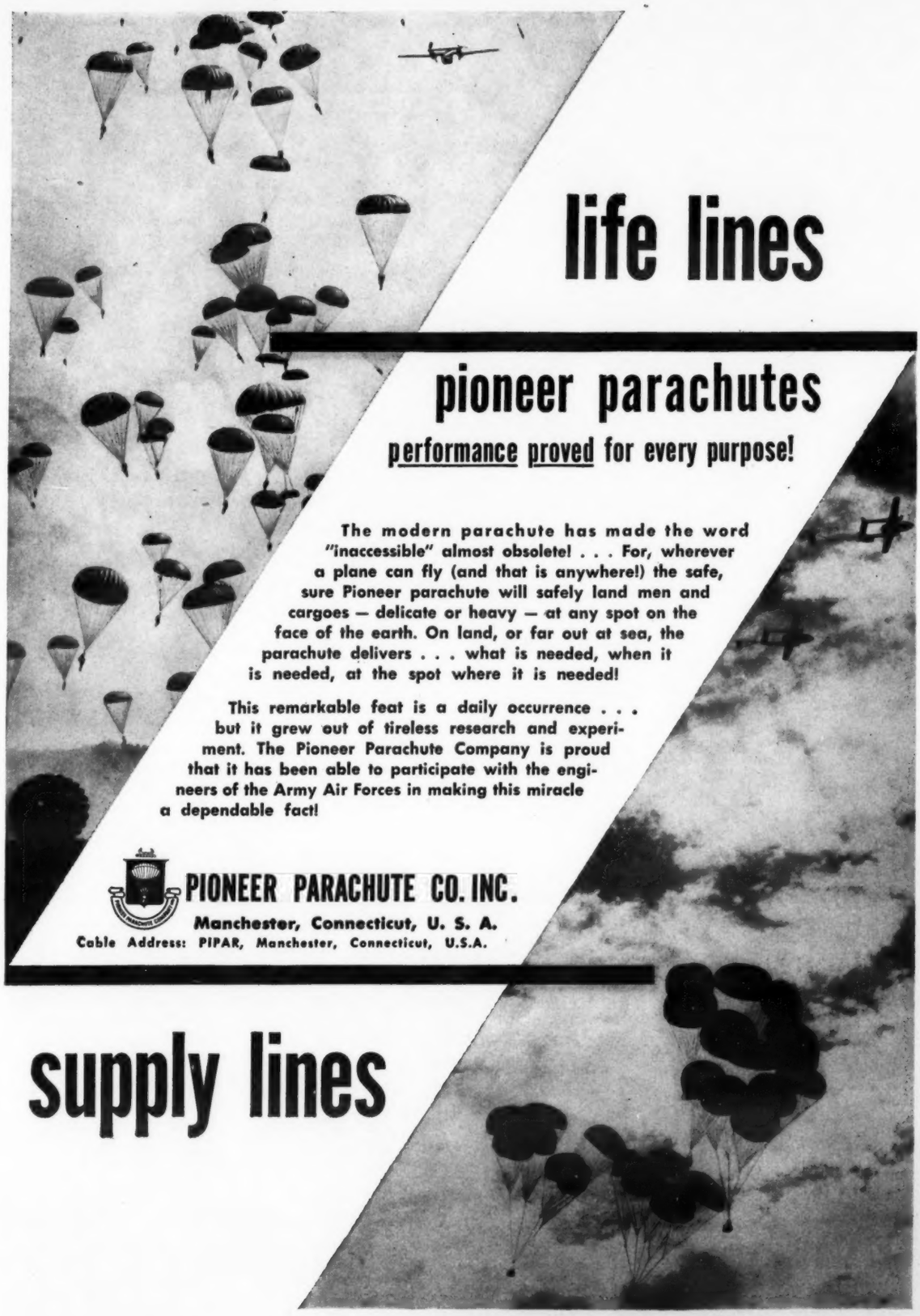

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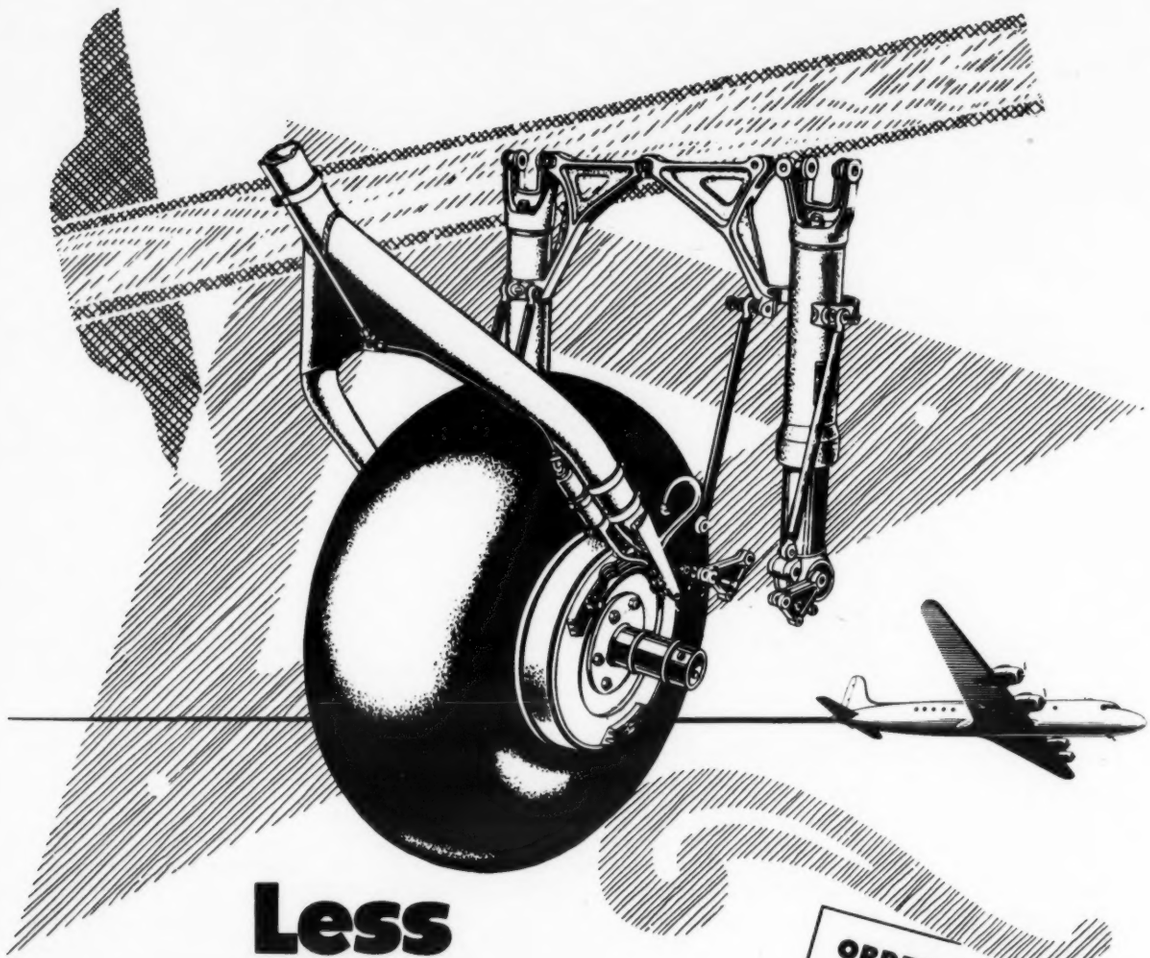

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Air Transport is Vital in War

BY PIERRE M. GALLOIS, PARIS

The value of airborne infantry has been seriously contested since the end of World War II. Yet it may come into its own again thanks to the tactical atom bomb, which renders concentration of surface forces impossible.

The example of Arnhem was not promising, and since then plans to develop airborne units with their own flying equipment have been restricted or even dropped. But today the strategists have come up against the problem of how to obtain the requisite striking power while at the same time remaining sufficiently fluid to cut down the effects of pocket atom bombs. The big A-bomb threatens large cities, and the baby "a-bomb" prevents concentrations on the battlefield. The advocates of airborne operations in global warfare point out that a mechanised division can spread out over more than 120 miles and take some ten hours to deploy. If five hundred aircraft are used, from eight or ten bases, and provided they can operate undisturbed, the same division can be moved 1200 miles in 24 hours and deployed ten times faster than if it were manoeuvring on the surface. And they evoke the famous definition: "Like mechanical force, the efficiency of an army in combat is the product of its mass multiplied by its speed of displacement." Although the mobility factor may be very great, it remains to be seen whether the "mass" is not reduced by the mobility resulting from transport by air. The question also arises of whether there is the same difference between airborne infantry and surface infantry as between carrier-based aircraft and corresponding land-based aircraft, where the latter are always superior to the former because of their freedom from the technical and operational limitations to which their naval rival is subject.

Do his weapons and his logistic support make the airborne infantryman equal to the surface infantryman ? Do the speed and ubiquity which he possesses compensate the relative lightness of his equipment and the precariousness of the "pipeline" which supplies him ? Experience hitherto has been too limited for any dogmatic theories to be built up on the subject. The answer will be "yes" if certain strategic and tactical conditions are combined, and "no" if they are not.

Meanwhile, the cold war and localized conflicts have given a new significance to air transport and are creating new techniques for it.

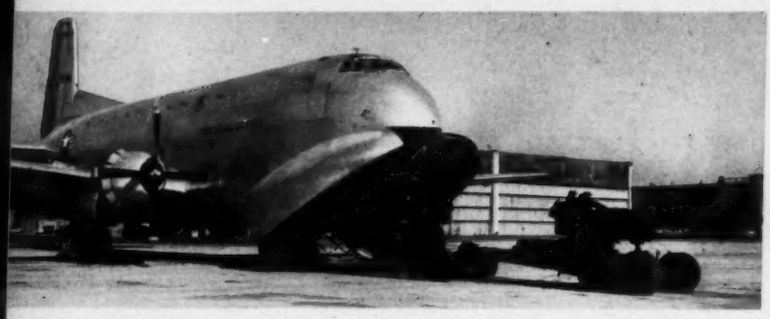
After Hiroshima and Nagasaki the Americans thought that it would be possible to police the world with the threat of the all-powerful combination of atom bomb and strategic bomber. As far as preventing a general world war goes, this assumption appears to have been justified. But all the other side has had to do to render the American A-bomb threat partially ineffective is to limit the pretext, nature and scope of hostilities by inventing the technique of localized wars, necessarily "subatomic" in character because of the relatively modest initial stake.

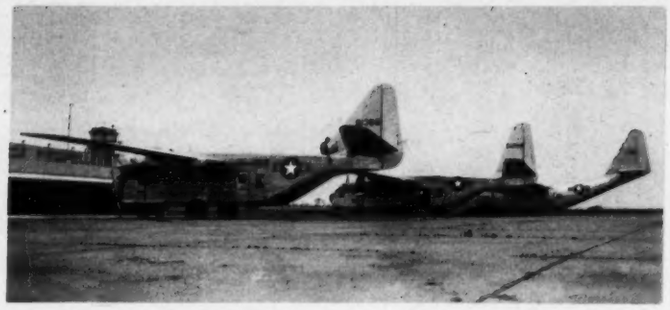
Value of strategic transports

As soon as the era of localized conflicts opened, the air transport advocates immediately pointed out the major part that could be played in cold war by a powerful strategic air transport force.

The world's present political situation necessitates permanent mobilization, which weighs heavily on national economies. A military air transport force can greatly reduce these expenses, for example, by making it unnecessary to maintain garrisons at all threatened points. For the United States it would provide an instrument for preventing local conflicts, just as the strategic A-bomber is a preventive against a world conflict. It seems a perfect answer to the natural wishes of the American citizen who, anxious as he is to preserve world peace, still does not like long service overseas. In times of crisis a "police force," carefully trained at home, could be moved even to the other end of the world in less than forty-eight hours, if need be, to re-establish order. The argument had been put forward often enough, and was taken up again with greater assurance—and better results—when the Korean affair broke out. Two months after the beginning of fighting in Korea the editorial writer of a big American magazine wrote that it was possible to meet the present cold war situation by taking full advantage

A good transport fleet saves garrison problems . . . Paratroops of the U.S. 82nd Airborne Division leaving their Fairchild C-119 *Flying Boxcar* at 1300 ft.





Two classes of aircraft are now required instead of one : left, the Douglas C-124 *Globemaster 2* heavy transport loading a tractor and a 203-mm gun; right, a number of Chase C-123 assault transports for 60 fully-armed men.

of mobility. What was needed was a number of units in a state of permanent readiness, highly trained, operationally equipped, capable of being transported by air and of taking off at an hour's notice for any point on the globe. This is the type of United Nations police force which could be very effective . . . The United States should therefore have several hundred long-range transports. In a few hours five hundred of these aircraft could move a division of special troops, complete with the equipment and supplies necessary for their initial operations.

In spite of the large fleet at the disposal of the Military Air Transport Service, it was obliged to call on equipment belonging to the commercial airlines. Although MATS's aircraft were more or less suitable for the Berlin airlift, they were not equal to the airlift across the Pacific. As long as its C-54's were working on the scale of European geography their performance was quite acceptable, but now distances were too great for them. For example, during the Berlin airlift American aircraft carried up to 8,000 tons a day into the beleaguered city, but they were

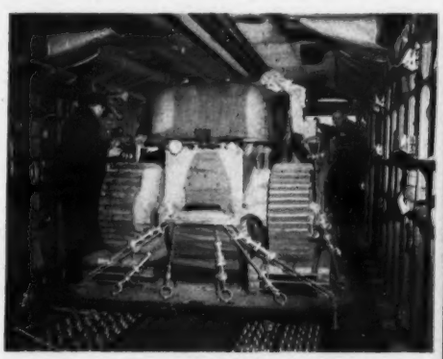
Parachutes as Weapons

The technique of "vertical warfare" developed during the second World War has been greatly expanded by the Americans and the Russians during the past few years and has been adapted to the most varied of purposes.

Advance : During the last United Nations offensive in Korea 3300 parachutists of the American 11th Airborne Division were dropped at one time, with light and heavy arms, ammunition and supplies, from 145 twin-engined Fairchild C-119 *Flying Boxcars*. Every year mass parachute jumps are also practised in the Soviet Union . . . so far only for training purposes.

Retreat : During the United Nations' retreat from Northern Korea, 20,000 American Marines (and infantry) were cut off near Koto by a blown-bridge. Eight steel bridge girders were dropped from eight Fairchild C-119's, each with the aid of several Pioneer parachutes. The bridge was rebuilt, and the whole unit, complete with vehicles, crossed in good order.

Construction work, etc. : In a recent exercise (Operation Test Drop) forty Fairchild C-119's dropped no less than 400 tons of heavy equipment to be used in building a 4000 ft. long emergency landing strip for heavy Douglas C-124 four-engined transports. Loads included two tractors and a heavy truck (weight 21,000 lbs. and 17,600 lbs. respectively), which were dropped by six 100-ft. parachutes each.



Ready to be dropped by six large parachutes . . . a 9½ ton tractor for the construction of an emergency landing strip (Fairchild C-119 over Fort Bragg, USA).

Men of the United States 11th Airborne Division, with weapons, ammunition and medical equipment, jumping from a Fairchild C-119 over North Korea.

Mass jumps by Russian paratroops from twin-engined Ilyushin Il-12 transports. They use square parachutes.

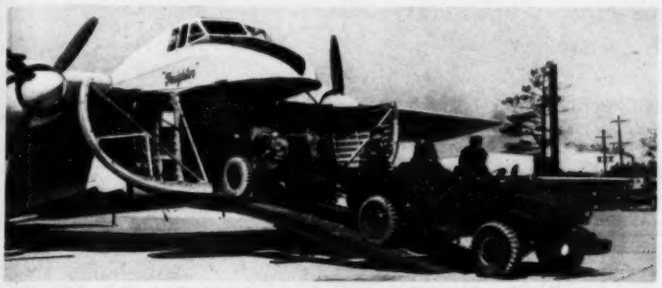
Today anything that can be carried in an aircraft can be dropped by parachute : troops, guns, jeeps, ammunition, fuel, food, medical and building supplies, life-boats. Reliable parachutes have been produced in the following types :

— back-type (automatic) and chest-type parachutes (hand release) for parachutists ;
— parachutes for crews of high-speed aircraft (used in combination with ejector seats) ;
— load parachutes 100 ft. in diameter (Pioneer) ;
— load parachutes 150 ft. in diameter (Pioneer) for heavy loads ;
— load parachutes 200 ft. in diameter (experimental) for loads of up to 5½ tons per parachute ;
— ribbon parachutes for braking aircraft landing runs.

Combat Zone Transports

FRANCE: Nord 2501 Noratlas (two 2040 h.p. Bristol *Hercules 739's*). The prototype set out for South America at the end of February, covering the 2670-mile Paris-Dakar stage in 14½ hours.

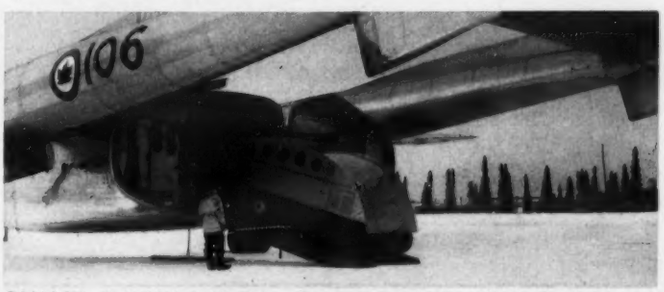
GREAT BRITAIN: Handley Page Hastings (four 1675 h.p. Bristol *Hercules 101's*) dropping two jeeps (each using four parachutes) over the Suez Canal.



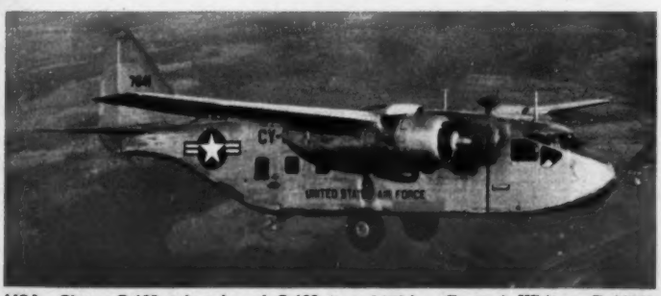
CANADA: Bristol 170 Freighter (two 2020 h.p. Bristol *Hercules 734's*) loading a Canadian Army field gun and jeep.

GREAT BRITAIN: Blackburn & General Aircraft Beverley (four 2010 h.p. Bristol *Hercules 761's* or 2950 h.p. Bristol *Centaurus 171's*) can carry a 30-seater complete with passengers.

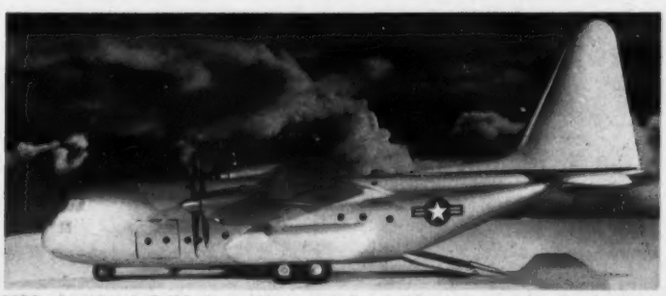
USA: Fairchild XC-120 Packplane (two 3500 h.p. Pratt & Whitney *Wasp Majors*) can leave its cargo pack (e.g., for 3200 U.S. gals. of fuel) at its destination.



CANADA: Fairchild C-119 Flying Boxcar (two 3350 h.p. Wright R-3350's) carrying a "snowmobile" to Goose Bay, Labrador. Alternative load: 64 paratroops.



USA: Chase C-122 (photo) and C-123 (two 1450 h.p. Pratt & Whitney R-2000's or 2300 h.p. R-2800's); U.S. Air Force assault transport for up to 60 troops, or guns and vehicles.



USA: Lockheed C-130 (four Allison propeller turbines), now under development, is to carry infantry, paratroops, vehicles or supplies.

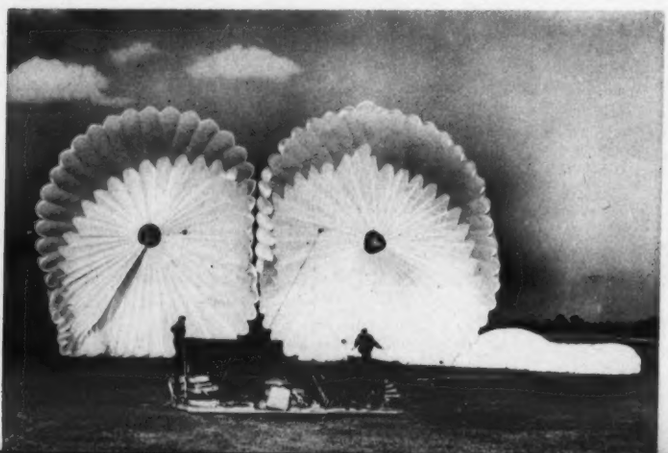
SOVIET UNION: Ilyushin Il-12A, and Il-12B (with dorsal fin extension) at Vnukovo Airport, Moscow. Two 1850 h.p. 14-cylinder Ash-82 two-row radial engines.

"The present cold war situation can be met by taking full advantage of mobility."

not able to lift more than 200 tons per twenty-four hours from the American Pacific coast to Japan and Korea. Moreover, the Korean conflict and the necessity of bringing up supplies rapidly over very great distances underlined the difficulties of keeping in continued employment the aircraft collected to meet the initial requirements of the Far East Commander-in-Chief. During the early days the transport capacity of the whole MATS fleet was ridiculously small compared with General MacArthur's demands. A month or two later, when the sea-borne supplies system had got going, the air transport fleet was amply sufficient. Quite often equipment was carried by air which could have gone by sea. On their return flights MATS aircraft operate the ambulance service which transports the wounded all the way from Wonju or Sinju to a hospital in California in about thirty hours. Today the Pacific airlift is organized to meet medical needs rather than supply requirements and has thus lost its logistic, though not its humanitarian and psychological, interest.

The American staff has always done its utmost to increase the "productivity" of its air transport fleet, and has now succeeded in equipping it with aircraft which are virtually identical with the commercial airlines' transports. It has also managed to follow the evolution of the commercial air fleets, in order to be able to use them more or less in their entirety in the event of general mobilization. Better still, it is not only fully aware of the composition of the commercial fleet, but it also keeps a check on its stocks of spares and has required designers to incorporate minor modifications to facilitate military use of a commercial type. Nevertheless, the immediate capacity of military and civil aircraft will never be sufficient to meet needs at the beginning of a crisis, and the provision and upkeep of a purely military fleet—frequently too big in more peaceful times—is extremely costly. Nobody denies today that the United States is the only country this side of the Iron Curtain which can maintain and develop a strategic air transport fleet specially organized for military duties.

During Anglo-American airborne exercises in Berkshire, a field gun and limber was dropped by three parachutes.



Vertical Warfare

Two families of aircraft instead of one

Until Korea it looked as if simple military versions of civilian transports would suffice. Civilian DC-3s, DC-4s, *Stratocruisers* and *Constellations* had become C-47s, C-54s, C-97s and even C-121s, and the military versions of the *Hermes, Viking* and *Dove* were named *Hastings, Valetta* and *Devon.* They provided the military with equipment which was perfectly suitable for the missions it was called upon to perform. The Americans were the only ones to design special equipment for airborne forces and for operations over the battlefield, namely, the Fairchild C-82 *Packet,* which has since become the C-119 with a greater variety of uses. The war in Korea seems to have thrown into relief a new need which had previously been perceived only dimly. Like the equipment of the other Air Force branches, the machines used for air transport needed to be specialized. The all-purpose cargo aircraft, like the *Dakota* of ten years ago, capable of supplying American troops overseas and of dropping parachutists on Sicily and Normandy, had to give way to several types of aircraft, each suited to a particular sub-division of air transport.

In France the Hurel-Dubois HD-31 narrow-wing design may make a good assault transport.

It was found necessary to increase the tonnage of strategic transports and reduce that of tactical combat transports to extend the services of the former by means of the latter ; cargos will have to be transhipped, admittedly, but will be carried over the last few miles at speeds corresponding to those of the long-distance transport. This is the origin of the assault transport concept.

Three years ago, the Berlin airlift had brought the economics of operating heavy aircraft into the limelight, and it is towards heavy tonnage, and of course high speeds, that the Military Air Transport Service looks when drawing up plans for its strategic transport fleet. The power plants required will be first compound engines and then, later, propeller turbines. Up to the present, except for the squadrons of Douglas C-124s, attempts at designing especially for military needs have not been particularly happy. The Convair XC-99 and Lockheed *Constitution* have remained interesting prototypes, since MATS prefers, as already mentioned, to use the same machines as the commercial airlines. As commercial traffic—passengers and freight—increases, the situation will remain unchanged for some time to come.

At the other end of the weight and performance scale there is today the assault transport. Chase and Northrop have worked on this class of aircraft in America, and in France Hurel's designs may meet these needs, thanks to their wings of very high aspect ratio. In this field, if not in that of the long-range transport, France still has a chance. The new importance of Africa may enable her to use the same kind of equipment for her assault transport squadrons—if she ever has any—and for carrying supplies to the "bush."

"Marginal" techniques in air transport

The sub-division of the transport arm and the introduction of the assault transport have raised problems for both aircrews and ground staff. Early in the autumn of 1951 an agreement between the American War and Air Force Departments on the use of flying equipment stipulated that the air units required for the Army (known as organic air units) should include all the aircraft used by the Army inside the combat zone to accelerate and facilitate the ground fighting and logistic support in the combat zone. It was understood that such aircraft should not overlap with Air Force aircraft which would carry out, on behalf of the Army, close support missions, assault transport and all other troop transport missions, aerial photography, tactical reconnaissance and destruction of enemy ground forces and communications.

But, by November 15th, 1952, General Lawton Collins stated that a new agreement had been reached with the U.S. Air Force, and the Army was now planning its own air units, comprising some 2200 helicopters and light aircraft. The former include a model capable of carrying a 155 gun. The latter comprise not only Cessna L-19 and Piper L-21 communications types, but also twin-engined Beech L-23 *Twin Bonanzas,* lighter than the C-47 and capable of taking off with heavy loads from small grass airfields. The American Army is thus growing wings, and the light transport, a close relative of the Air Force's assault transport, will be flown, like the communications aircraft and the artillery spotter, by Army pilots.

During the past three years theories and techniques of military air transport have been consolidated. Strategic transport fleets, with their special equipment, go hand in hand with the long-range bomber fleets and become the adjunct of the "very great." On the other hand, lighter cargo aircraft, known as assault transports, remain within the reach of other countries, even though their production in quantity still depends on the priority which they can get on the air force credits of these nations. Finally, in spite of the specialization of its equipment, military air transport is still closely connected with commercial transport and with the ground forces. With the former it shares its long-range transports, and with the second it will share the light cargo aircraft to bring up men and material to the front line.

Yesterday:

The Battle of Arnhem-Nijmegen

BY GENERAL W. PICKERT (retd.)

The following article analyses a practical example of an airborne operation, to supplement the foregoing theoretical discussions of airborne strategy and general review of airborne operations during the Second World War. Admittedly a great deal has already been written about the battle of Arnhem-Nijmegen, but this is one of the reasons why this particular example has been chosen, as many of the details of the operation can be assumed to be known, and it has thus been possible to limit the article to a brief assessment of the decisive factors.

The writer fought as an artillery officer in World War I and transferred to the Air Force in 1935. As a Staff Officer attached to a number of senior commands, in both peace and war, he was concerned primarily with questions of air defence and defence against airborne landings. From 1940 to 1942 he was Chief of Staff of German Air Defence. At the time of the invasion of Normandy he was in command of the 3rd German Flak Corps, Northern France. EDITOR

Foreword: The following remarks are based primarily on Chester Wilmot's book, "*The Struggle for Europe,*" published by Collins, St. James's Place, London in 1952. (A German translation is to appear shortly.)

Wilmot's account is of particular interest, because he had access to a great many German and Allied documents which previously had not been generally known.

The strategic situation in September 1944

By the beginning of September 1944, the Allied forces, i.e. Montgomery's Army Group, or more exactly parts of the British 2nd Army under Dempsey, had reached Brussels and Antwerp. Bradley's U.S. Army Group in the south, which was suffering from supply difficulties, and units of the U.S. 1st Army (Hodges) were advancing along a broad front on either side and in the Ardennes, whilst still further south Patton's 3rd Army was pushing hard against the upper Maas (Meuse). Behind Montgomery's front the Canadian 1st Army had swung round to attack Le Havre and the other Channel ports. The U.S. 9th Army was pressing on Brest, and the U.S. 7th Army, which had landed on the French Mediterranean Coast, was nearing Dijon.

Supply difficulties had forced large parts of both Army Groups to a standstill. Except for the airlifts, all supplies were still coming up by road from the beachheads in Normandy and, to a small extent, from the newly-opened port of Cherbourg. The railways were still unfit for use.

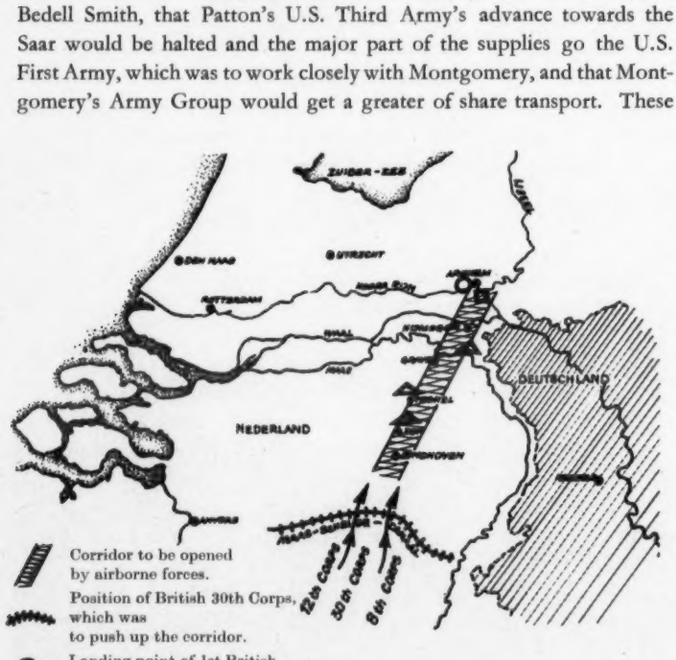
The Germans had their relatively intact 15th Army north of the Escaut (Schelde) and the Escaut Canal. The 1st Parachute Army was still south of the Albert Canal, while the West Wall was manned by an entirely inadequate, badly battered force, in part hastily assembled, that was trying to collect and re-form itself. Small reinforcements for the West Wall were moving up.

It seemed to the Allies at this beginning of September that if a rapid blow could be struck by seasoned, highly mobile troops, the West Wall could be overcome and the Rhine crossed, so that a deep thrust into Germany could end the war that same autumn. Patton in the south,

having correctly judged the situation, was pushing hastily forwards and demanding priority in supplies to sustain his advance. Field-Marshal Montgomery, who had also sized up the situation, was urging that a rapid advance be made on the northern flank, to take the Ruhr and to continue across the North German plain. This plan would also have required troop reinforcements and above all an increase in supplies. General Eisenhower, the Allied Supreme Commander-in-Chief, had a strategic reserve ready in England, the Allied Airborne Corps with four airborne divisions. Eisenhower originally planned to send this reserve in on the northern flank of Bradley's U.S. Army Group, to keep the attack going by using airborne forces in the Maastricht—Aix-la-Chapelle area, enable the West Wall to be overrun and the Rhine crossed preparatory to the capture of the Ruhr. At the same time, the general advance over a wide front was to continue with the remaining forces. Bradley, however, objected, as he had little confidence in airborne operations and would have preferred to have the transport aircraft used to bring up supplies.

At this point Montgomery asked that the airborne forces be put under his command for a thrust to Eindhoven and Arnhem and on to the Zuider Zee. He had recognized that speedy action was essential to prevent the Germans from assembling and strengthening their forces. There was yet another reason for advancing towards the Zuider Zee : on September 10th the Germans had begun to fire V2 rockets against London from launching ramps near The Hague. By a rapid advance to the Zuider Zee supplies of this unpleasant new weapon could be cut off and the V2 attacks stopped.

Eisenhower agreed to Montgomery's plan with reluctance, as he still wished to continue his advance over a broad front. Meanwhile, the port of Le Havre was to be freed and the mouth of the Schelde opened—Antwerp had already been captured almost undamaged—to improve the supply situation. Montgomery's proposed thrust towards the Zuider Zee was to be merely a cover for the left flank. Montgomery hoped, however, that once his forces had reached the Zuider Zee they could rapidly swing eastwards and march into Germany. He had also had an assurance on September 9th from Eisenhower's Chief of Staff, Bedell Smith, that Patton's U.S. Third Army's advance towards the Saar would be halted and the major part of the supplies go the U.S. First Army, which was to work closely with Montgomery, and that Montgomery's Army Group would get a greater of share transport. These promises enabled Montgomery to set the date of the projected operation —code name "Market Garden"—for September 17th, 1944.



Corridor to be opened by airborne forces.

Position of British 30th Corps, which was to push up the corridor.

Landing point of 1st British Airborne Division (west of Arnhem).

American landings : 101st Division north of Eindhoven and 82nd Division south of Nijmegen.

Planned landing by Polish Airborne Brigade south of Arnhem road bridge.

During these preparations the 30th Corps of the British Second Army had forced a crossing of the Albert Canal near Beeringen, in the face of tough German opposition, and had established a bridgehead over the Maas-Schelde Canal north of Hechtel as a base for the projected break-through. The 11th Armoured Division of the 8th Corps was brought up from Antwerp on the right flank of the 30th Corps. The remaining 8th Corps forces were still for the most part immobilized on the Seine because of the shortage of supplies, and their supply columns were going up to the British 2nd Army. To the left of the 30th, the 12th Corps had worked its way across the Albert Canal up to the Maas-Schelde Canal. Strong German resistance and swampy ground were holding up their advance. The supply columns available to Montgomery's Army Group, however, were sufficient only for a broad advance by two divisions of the 30th Corps (Guards Armoured Division and 43rd Division). This was a basic weakness of the plan.

The plan of attack

The plan for "Market Garden" described the operation as follows : the Allied 1st Airborne Corps under Browning, using three airborne divisions, was to capture a long narrow corridor running up through Eindhoven, Nijmegen and Arnhem. The 30th Corps was then to push up the corridor from the south beyond Eindhoven and Arnhem to the Zuider Zee.

The following drop zones were planned : U.S. 101st Airborne Division (Taylor) north of Eindhoven between Veghel and Zon, U.S. 82nd Airborne Division (Gavin) south of Nijmegen between the Maas and the Waal, 1st British Airborne Division (Urquhart) West of Arnhem. The three divisions were to take the road bridges over the Maas, Waal and Neder Rijn (Lower Rhine) and five other waterways, and thus create a 50-mile corridor for the armoured and motorized units of the 30th Corps coming up behind.

This extremely daring plan involved considerable risk. Powerful German flak defences at the targets, strong fighter units at nearby airfields, represented a threat even during the airborne forces' approach. The situation in the air was also threatening to turn to the Allies' disadvantage, as the first German jet fighters (Me 262) were beginning to appear. Furthermore, the 30th Corps might be held up in its advance, by blown bridges for example, and arrive too late to relieve the airborne forces. Finally, the narrow corridor might be cut off by the German forces. *The greatest danger, however, was the extent to which the whole plan depended on the weather, since there were insufficient aircraft available to fly in the whole of the airborne troops on one day, and drops had be spread over two or three days.* Fully aware of these serious dangers, Montgomery yet felt that the first powerful blow by the giant airborne force, the biggest airborne operation ever staged up to that time, would throw the Germans into such confusion that success would be likely. His object was to shorten the war by a bold large-scale manoeuvre.

In addition to these factors of uncertainty, the plan for the British 1st Airborne Division had yet another weakness. *Experience of airborne operations early in the invasion of Normandy had shown that—particularly when bridges had to be captured—airborne troops had to be set down as close as possible to the target or even on the target itself.*

A convincing example of this was the success of the British airborne operation east of Caen. Here forces were set down on and close beside the two Orne bridges they were to capture, on a moonlight night. It had been clearly proved that it was better to land on or very near the target and risk the casualties involved than to fight a way through to the target after landing. This lesson was not used at Arnhem, because

in the view of an alleged expert troops landed next to the bridge at Arnhem would suffer heavy losses through the powerful flak defences stationed there, and because the ground immediately south of the bridge was too soft to land the gliders on. Also the 1st Airborne Division had suffered heavy casualties during an operation in Sicily in 1943, by landing amid the enemy, and had been almost wiped out. The Division, therefore, felt that it was better to land some distance away but successfully, and then fight through to the target. As, too, the divisional commander himself had had no airborne experience, the landing was planned for these reasons to take place about 10 km west of Arnhem and the main target (the road bridge). The risks entailed in this plan were increased by the fact that the division could not be landed all at once, but had to be flown in at three different times.

This meant that on the first critical afternoon (the attack was to be made in the early afternoon) there would be only lightly armed parachutists and the reconnaissance forces to push through to the bridge and that reinforcements could not be sent in until 24 hours later. The plan thus undoubtedly sacrificed the advantage of a surprise landing direct on the target and exposed the divided forces to the danger of being overwhelmed on the first day.

17th September, 1944 : American paratroops boarding their C-46 at an airfield in southern England ready for operation "Market Garden," the airborne battle for Holland.

The battle

ARNHEM, September 17th, 1944 : On the appointed day, roughly 1,000 bombers attacked German airfields in Holland and flak batteries in the projected landing zones. About mid-day a giant air armada of some thousand troop transports and 500 gliders, with a cover of more than 1,200 fighters, set out from England. Only fifteen German fighters were encountered ; the bombing of the airfields prevented the rest from taking off. Not one of the 1st Airborne Division's transports or gliders was lost through enemy action on this first day. This terrific force of aircraft took the Germans completely by surprise. However, it so happened that both the responsible commanders, Field-Marshal Model, Commanding Army Group B, and General Student, Commanding the 1st Parachute Army, were in the threatened area that day and could, therefore, take immediate action. Model hurried to Arnhem, took over from the local commander, who had been killed in the bombing, organized his forces and alerted the 9th Panzer Division north of Arnhem. By a further lucky chance, Student found the orders for the whole operation in a British machine that had been shot down. Hence, highly effective German counter-measures could be organized immediately.

The 1st Airborne Division's parachutists and gliders reached their appointed landing zones west of Arnhem and met with little opposition at first. Admittedly, 38 out of the total of 358 gliders failed to reach their target, most of them because of broken tow-ropes. Unfortunately, they were the gliders carrying the armoured jeeps for the reconnaissance squad which was to have taken the Arnhem road bridge by a rapid manoeuvre. The 1st Airborne Brigade (Hicks) secured the landing zones, while the 1st Parachute Brigade (Lathbury) went forward towards Arnhem. One company made for the *railway bridge* west of Arnhem. It arrived just too late ; the bridge blew up before their eyes. The other companies met with stiff resistance on their way to the Arnhem *road bridge* and had to fight their way forward yard by yard through the streets.

Meanwhile, the road bridge would have been defenceless against a direct airborne attack ; the German guards, all World War I veterans, had disappeared after the air raids, leaving behind a solitary Dutch policeman. But by the time British parachutists reached the north end of the bridge shortly after 8 p.m. the situation had radically changed, and their attempt to cross the bridge broke down under withering flak artillery fire. All they could do was hold the north end of the bridge with 500 men and an anti-tank gun. Reinforcements were held up on the western outskirts of Arnhem by an S.S. Training Battalion, which was soon reinforced by six tanks and a number of armoured vehicles from the alerted German 9th Panzer Division. The British divisional commander and the paratroop commander found themselves cut off from their troops by the fighting, attacked on all sides and with no means of communicating with them, as their radio had broken down.

If the airborne brigade had abandoned the landing zones and moved up into the bridge fighting, the situation might still have been saved. But it had received specific orders to hold the landing zone free of the enemy for the next landing.

*

NIJMEGEN-EINDHOVEN, September 17th, 1944: The Americans were somewhat more successful. The 82nd Airborne Division met with little resistance and captured the Maas bridge at Grave undamaged within an hour, and another bridge over the Maas Canal by nightfall.

Coming down near Nijmegen for the push to the Maas bridge at Grave.

It also took the Goesbeck height between the Maas and the Waal with a small force. On the other hand, the troops advancing towards the Nijmegen Bridge ran into strong German defences 500 yards short of the river, and failed to get through.—The U.S. 101st Airborne Division had made its parachute and glider landings north of Nijmegen under heavy flak fire and had lost 73 transports and gliders. It succeeded in taking all four bridges in Veghel intact, but the bridge at Zon was blown up by the Germans. Here, too, a direct landing alongside the bridge would probably have prevented it from being blown up. The troops landed too far away and arrived too late.

On the whole, Allied operations ran according to plan the first day. But it was the second day which was vital to the success of the overall plan, particularly the weather, which would decide whether airborne landings and ground fighting could be successfully continued.

*

ARNHEM, September 18th, 1944: Fog at the airfields in England delayed the take-off of the second airborne wave by five hours. Strong German counter-attacks hemmed in the forces which had already landed, and the Divisional Commander himself narrowly escaped capture in the street fighting: he had to hide for hours in an attic. Having no radio, the troops could not ask for air support against the attacking German tanks and infantry. A British attack north of Oosterbeek cost the two attacking battalions nearly half their strength. Thus, the fighting round Arnhem remained indecisive throughout the day.

*

ARNHEM, September 19th, 1944: Another day which brought the hard-pressed troops no relief. A new attempt on the bridge failed, so that the Divisional Commander, who had by now managed to rejoin his forces, decided to dig in and await the arrival of the British 30th Corps.—Once again heavy fog in England delayed take-off by the airborne reinforcements and above all prevented the arrival of a Polish airborne brigade which was to have landed south of the Arnhem road bridge. Only 60% of the 650 transport aircraft and 430 gliders arrived over the target. Unfortunately for the 1st Airborne Division, their new supplies—about 390 tons of ammunition and food—fell into the hands of the Germans, who had already re-occupied the dropping zone. Because of the breakdown in radio communications, it was impossible to fix another dropping zone. On this day the German jet fighter units were in control of the skies over Arnhem, and 112 gliders and 40 transports were shot down by German flak and fighters.

*

NIJMEGEN-EINDHOVEN, September 19th/20th, 1944: In the Nijmegen area, the Guards reached the wood south of the town on September 19th via the repaired bridge at Zon. They found the Americans on the defensive against strong German attacks from the Reichswald, and no further advances towards the Nijmegen bridges could be made until late afternoon, when a parachute battalion arrived in support. Stiff German resistance made it impossible, however, to reach the bridges. Still, hope was not abandoned that the road bridge could be taken the next day by a flanking attack across the Waal from the North.

The 1st British Parachute Brigade (Lathbury) had to fight its way yard by yard through the streets of Arnhem. Germans setting up a 2-cm flak gun.

On the evening of September 20th the Nijmegen road bridge finally fell into Allied hands. A little later the first Guards tanks hurried across the bridge northwards towards Arnhem, but ran into strong German opposition after a few miles and could get no further.

*

ARNHEM, September 20th, 1944: In renewed attempts to supply the airborne forces from the air, 29 out of 119 gliders were shot down. The British bridgehead had shrunk to 140 men and was finally overcome in the afternoon. The Arnhem bridge returned to German hands, and three hours before the Nijmegen bridge was taken by the Allies, the first German tanks were rolling southwards across the Arnhem road bridge.

*

ARNHEM-NIJMEGEN, September 21st to 25th, 1944 (30th Corps' attempt at relief). What had meanwhile been happening to the ground units, the 30th British Corps which was in readiness on the Escaut Canal to push up into the air landing area? On receiving the first reports that the airborne landings had gone according to plan, General Horrocks, Commanding the 30th Corps, had set out, straight away on September 19th, with strong armoured forces along the road towards Eindhoven, but had not been able to relieve the encircled bridgehead at Arnhem.

In ignorance of the situation at Arnhem, General Horrocks expressed the hope, as late as the evening of September 20th, that he would be able to help the 1st Airborne Division at Arnhem the next day. His optimistic view of the situation was soon to be changed. At about 9 a.m. on September 21st he managed to get into radio communication with the 1st Airborne Division, which gave him a picture of the critical situation at Arnhem but did not tell him that the British bridgehead on the Arnhem road bridge had already collapsed—a fact of which General Urquhart was himself unaware. Horrocks tried again to get through to relieve Arnhem, but did not succeed in breaking the German resistance on the Elst-Arnhem road. Bad weather again prevented the arrival of airborne forces that were supposed to move up from Nijmegen towards Arnhem. In the narrow corridor between Eindhoven and Nijmegen there was only one road leading northward, and this was under constant German fire and had repeatedly to be cleared. Open formation (because of gunfire), mining of the road shoulders and ditches on either side of the road slowed down the advance. Finally, there was no RAF support in the Nijmegen area, because there were no radio communications.

Dropping supplies near Arnhem.

By the evening of September 21st, as the situation had so much deteriorated, Horrocks had given up the plan to push forward via Arnhem to the Zuider Zee, but still intended to form and maintain a bridgehead across the Neder Rijn west of Arnhem. No landing craft were available, so that it was only possible to put a small force across the river at night, using makeshift rafts from the steep, soft river bank. This operation was facilitated by the fact that the long-awaited Polish Airborne Division had finally managed to land, despite concentrated flak fire and heavy losses, on the south bank of the Neder Rijn, South of Heveadop, during the afternoon of the 22nd. The situation thus seemed to have become a little less tense for the 1st Airborne Division.

The end

Meanwhile, fresh difficulties had arisen for the Allies north of Eindhoven. German forces had succeeded in cutting the only available road, at Veghel and Uden. It was not freed again until about mid-day on the 23rd. Valuable time, during which reinforcements, supplies and bridging material could have been brought up, had been lost.

On September 23rd bad weather stopped all flying and prevented urgently needed supplies from being flown in. Some reinforcements got across the Neder Rijn west of Arnhem, but at the cost of heavy casualties ; out of 250 men only 150 got through to the 1st Airborne Division. As it was still impossible to bring up landing craft or pontoons, no more reinforcements could cross the river until the night of the 24th, when 250 men got across. Shortly afterwards, German forces cut off the river bank. During the night, Urquhart received orders to withdraw the 1st Airborne Division back across the Neder Rijn . . .

This momentous order marked the failure of the whole daring operation of "Market Garden." The rest of the 1st Airborne Division managed to get back across the river to the west of Arnhem on the night of the 25th, under cover of wind and rain and unperceived by the enemy. Wounded who were unable to walk covered the retreat with fire and misled the enemy with fake radio conversations. Out of about 10,000 men who had landed on the other side of the Neder Rijn, only 2,160 came back. About 6,000 were taken prisoner by the Germans during the fighting, many of them wounded. The rest were killed.

Critical remarks

The strategic objective, namely to take the British Second Army across the Maas and the Neder Rijn up to the Zuider Zee and then along the Ijssel for a knock-out blow across the north German plain, was not attained. Although eight bridges were captured, the whole operation failed on account of the vital ninth bridge at Arnhem.

24th September, 1944 ; Following the order to withdraw across the Neder Rijn the 1st British Airborne Division evacuated over 200 transportable wounded.

Allied ferry equipment destroyed in Arnhem wood.

What were the reasons for this failure ? At Arnhem the airborne forces were set down too far from their target, the road bridge over the Neder Rijn. Six valuable hours passed before they reached the bridge. Flak defences at the bridge had been overestimated. By attempting to avoid initial losses, even greater casualties were later sustained, and the whole undertaking failed. The indisputably first-class troops available could and should have landed alongside the bridge itself, even under heavy fire. The same applies to the bridge at Zon, north of Eindhoven ; the American airborne forces also failed to land on or near the bridge, and the Germans thus had time to blow it up. The British armoured forces were therefore held up for twelve valuable, perhaps vital, hours. It is impossible to avoid feeling that full advantage was not taken of the time and surprise factors, which are the hallmarks of all airborne operations. Was the enemy also underestimated ? It may have been thought that German morale was already broken.

Chester Wilmot, in summing up, gives it as his opinion that the failure was partly due to the disastrous effect of two weaknesses in the Allied command : fear of losses and unwillingness to concentrate forces at decisive points. In a blow to end a war casualties should not play too great a part or questions of prestige prevent the concentration of forces. Once Eisenhower had let his tactical reserve, the airborne forces, out of his hands, it was logical that the decisive blow should be struck at the point where this reserve was employed, and that the operation should be backed by highly-concentrated forces and a fully adequate supply organization. Wilmot considers that this was not done to the fullest extent possible. He hints that for political reasons it was considered impossible to allow Montgomery to give the Germans the *coup de grace,* and hold back Patton.

Undoubtedly, bad weather conditions had a serious effect on the operation. The decisive extent to which large-scale airborne operations, when they have to be spread over several days, depend on the weather, comes clearly to light here. The strategist must always make allowance for this dependence on the weather, so as to avoid failure. The misfortune of air supplies going astray or failing to arrive is also important, as are communications difficulties. However, these circumstances are not decisive.

The underlying reason for the disastrous outcome of "Market Garden" is perhaps in its basic planning. The operation was doomed to failure because *the airborne forces were scattered over too wide an area* and the corridor planned was too narrow and too long, in spite of the powerful airborne forces available. *The ground forces which could move up the single road in this corridor would have been too weak,* even if German resistance had been feebler, to push through beyond Arnhem. The narrow corridor could not have been enlarged with the available forces, and it would only have been a matter of days before it was cut. This disproportion between forces, time and space inevitably caused the operation to fail—in spite of the heroism of the airborne troops involved.

Tomorrow:

"Soviet Paratroops over Western Europe..."

BY ***

November 195 . . .

At 22.45 the roar of an engine suddenly pierced the darkness of the empty streets in the little town of Neustrow, Mecklenburg.

The noise increased. Becoming deeper and duller, it filled the air and shook the ground. Like a thousand streams pouring into a river, other engines added their clamour to the great wave of sound. The first heavy transport took off at 23.28, followed by another less than thirty seconds later. This was kept up for more than an hour. Other North German aerodromes were also springing to life, launching their formations of four-engined transports. From Schwerin to Stargaard in the North, from Rathenau to Küstrin in the South, the sky was full of the roar of engines. Flying at low altitudes, with all lights out, and in groups of varying sizes, the Russian cargo aircraft set course for the North.

Three hundred miles further South—and about an hour later—the countryside of Czechoslovakia came to life in its turn. From ten airfields in the Pilsen—Budweis—Prague—Jihlava area, about five hundred twin-engined and four-engined transports took to the skies. At 00.58 the first Il-18 of Transport Group II, based in Czechoslovakia, turned southwards, leading a pack of similar aircraft, all heavily loaded. At 03.45, with the departure of the last Tupolev Tu-70, Pilsen airfield fell silent again. Torn out of their winter torpor, towns and villages sank back again into the immobility of night.

At the same moment several hundred transports, big with airborne battalions, were rumbling down airstrips in Rumania, at the foot of the Transylvanian mountains. They too turned south.

*

Exactly at 06.00 (GMT), more than 40,000 men parachuted from heights of about 300 ft. and set foot in the streets and on the roofs of twenty of Western Europe's biggest ports. In the eastern Mediterranean Athens, the Dardanelles and Crete had fallen victim a few moments earlier to the first wave of a powerful assault from the air.

At the same time, Russian infantrymen landed on buildings, streets, squares and harbour installations at Copenhagen, Bremen, Antwerp, Dunkirk, Calais, Dieppe, Le Havre and Cherbourg on the North Sea and Channel Coasts. Brest, Lorient, Saint-Nazaire and Nantes on the Atlantic Coast were attacked in the same way and at the same time.

*

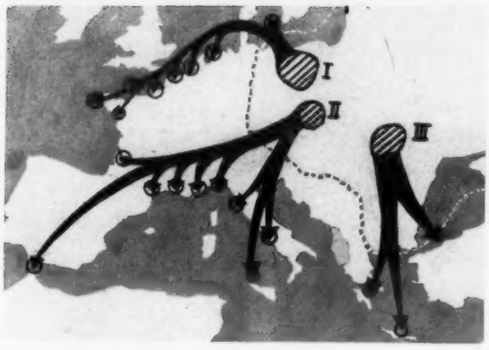
These were the targets allocated to Transport Group I, based on Northern Germany. So as to deceive the radar observers as much as possible, the units flew north at first, splitting off a group of sixty PS-84s towards Copenhagen en route. Then, skimming across the Danish peninsula, the *gros* of the force headed southwest, offshore along the German, the Dutch, Belgian and French coasts. On arriving near the ports of Bremen, Antwerp and Calais, groups of Il-12s, Il-18s and Tu-70s broke away to drop their loads of men and equipment on these targets. The Russians' whole range of twin-engined and four-engined transports, from the *Dakota* (PS-84) and the Ilyushin Il-12 to the Il-18 and the Tupolev Tu-70, had been pressed into service, according to the distance and the size of the towns to be occupied or to be deprived of their harbour installations.

Group II, with the same equipment, had been given the task of sealing off, permanently or temporarily as the case might be, part of the Atlantic coast and the whole of the European shoreline in the Western Mediterranean. At 06.00 (GMT) more than 20,000 airborne infantrymen rained down on Bordeaux, Gibraltar, Marseilles, Toulon, Genoa, Leghorn, Palermo and Naples. Gibraltar alone got 7,000, dropped from 120 Tu-70s. This was not a mission of destruction, but an operation in force to bolt up the western end of the Mediterranean.

The commander of Transport Group I had instructed his force to fly at a low altitude over the sea, so as to avoid detection as long as possible. His colleague in Group II made use of the cover provided by the Alps, sending his squadrons through the field of permanent echoes on the Allies' radar screens. The main body reached the Alps near Salzburg, then bore west and followed the mountain range to south of Grenoble. The Pyrenees then served as similar cover for the Il-18s which attacked Bordeaux.

*

Within a few moments the various capitals had been alerted, all more or less simultaneously. Earlier in the night a number of radar posts had reported abnormally large-scale aircraft movements which they thought were suspicious. But the routes followed were unexpected and overlapped into too many national radar surveillance zones for much attention to be given to these reports in the various countries—particularly at two or three o'clock in the morning, when watch duties are especially tedious. The surprise was therefore complete.



Timing, routes and aircraft had been cleverly worked out to make sure that all the targets, regardless of their varying sizes and their distance from the bases of departure, were invested from the air at the same time, from Copenhagen to Naples.

Later it was learned that the missions allocated to the paratroops were not everywhere the same. As governments knew nothing whatever of the attackers' real plans, panic made retaliation impossible. The attack on Copenhagen was reinforced during the day by heavily escorted transport aircraft.

Moreover, a few moments after the airborne assault, cruisers equipped to fire guided missiles had anchored off the capital, their launching ramps threatening the city like cannon of old.

Bremen, which was to be occupied that evening by Red tanks approaching along the coast, was not to receive reinforcements. The object of the airborne attack was merely to form a "sore" to draw off the local defences, which were attacked from behind and in front. At Le Havre and Cherbourg, the mission had been merely to destroy the harbour installations and obstruct the entrances to the ports by sinking ships in them. Then the attackers were to organize themselves into a stronghold ready to receive further supplies by air during the following nights and capable of keeping the maximum number of French troops occupied.

*

Gibraltar was to be held and captured. It is now also known that a wave of Cher-4 three-engined transports landed heavy equipment, such as 105-mm guns, T. 34 tanks, etc., there the next day . . .

*

Looking back, it seems that this gigantic encirclement operation might have been less decisive and hence less successful than it was. The forces dropped the first day were not great—less than 60,000 men from Denmark to the Dardanelles, passing through Gibraltar. Operating in isolated groups, cut of from their bases by the Allied fighter forces now aware of the areas to be denied to the Russian supply aircraft, the Red paratroop forces could have been, if not ignored, at least easily contained without distracting the western forces from their essential tasks. From the military standpoint, the closing of the ports of Western Europe could be nothing but temporary and consequently of little effect on the outcome of the first phase of the new world conflict. Admittedly, the harbour installations were more or less destroyed, but the West was sufficiently well equipped to make good this destruction.

In fact, the attack was so sudden, of such broad scope and launched simultaneously against so many vital points that it had a double result. It foreshadowed for Europeans an almost immediate occupation of the whole of the Continent and an A-bomb ultimatum, paralyzing Great Britain and Spain for a time. It discouraged the aid which had been counted on from overseas. Not only were material means lacking to land arms and men on Continental Europe, but all Allied European outlets towards friendly countries had fallen into enemy hands within a few hours, or even a few minutes in some cases.

Inside Fortress Europe, cut off from outside aid by the blocking of its ports, the airborne attack hinted at plans for invasion and occupation backed by huge material resources. Outside, the assault, which had cut the lifelines through which Europe drew part of its strength, called for caution and recourse to peripheral action from non-European territories still in Allied hands.

Three or four years earlier, when the United States, Britain and Canada were still "engaged" on the actual territory of Europe through the Anglo-Saxon divisions stationed there, the view of overseas governments might perhaps have been a different one.

But by November 195... the distribution of Allied forces had been modified at the request of the European nations themselves.

The sequence of events which was so completely to alter the world situation and once more produce so many ruins, is fresh in everyone's memory.

At 06.05 the first Russian patrols moved on to telephone exchanges, occupied railway stations, began demolishing cranes and loading platforms along the quays. A few minutes later, heads of governments, rudely awakened, learned, if not of the full scale of the attack, at any rate of the airborne raids on Antwerp, Dunkirk, Brest and Lorient. At 06.15 (GMT) Washington was informed of such of the opening events as were known in the capitals. The alarm had been sounded by private telephone and radio connections, and by seven o'clock rumours, some magnifying, others minimizing events, were rife. News came pouring in as hastily-summoned cabinets discussed the situation. But Le Havre, Bordeaux, Port-Vendres no longer replied. Brussels knew that half of Calais was occupied and Rome had heard not only that Naples was entirely surrounded but also that Antwerp was isolated and Bordeaux reduced to silence . . . As Bonn had also reported that the line of demarkation between the two Germanies had been crossed in force, governments and military hesitated over what orders to give and asked Washington about its plans.

By 08.30 it was known in Brussels and by 08.40 in The Hague and Paris that, although America would throw all her forces into the struggle, there could be no immediate mass intervention on European territory. Liberation would certainly come, but when ? At 08.45, in a second proclamation, the Government announced that it was resigning to "make way for a new authority composed of men better equipped to negotiate the safety of the country and, if this should prove impossible, to protect its population and property." Bonn, Brussels, Rome and The Hague all made similar announcements to their citizens and the world at large within a few minutes. Fighting was breaking out everywhere. But by 09.30 in Paris and at about the same time in the other capitals, heads of States were receiving members of new cabinets . . .

It is now known that the initial operation used only about a thousand transports for the capture of the targets assigned to Groups I and II. Group III, responsible for seizing vital points in the Eastern Mediterranean and preparing the advance of the satellites' ground divisions, carried on sustained operations for over a week. The nature of the ground and above all the presence of the Anglo-American Mediterranean fleet meant that the bridgeheads had to be constantly supplied from the air. Altogether some 2000 medium and heavy transports went into action, more than half of them taking part in the initial attack only. It is certain that although political and military conditions combined to make this "encaging" of Europe possible, it was the psychological shock produced by the simultaneous locking of all the doors through which Europe could receive aid from outside which was the determining factor.

Assault Transports and Helicopters

"Operation Summit": One hour after an assault unit disembarking by means of knotted ropes had set foot on the hill-top, the first Sikorsky S-55 landed. Another twenty fully-loaded S-55s followed at brief intervals.

In addition to battles of encirclement, hedgehog positions and widespread strategic bombing, the innovations of the last war included two great pioneering ideas : *"assault by armoured spearhead"*—break-through by General Guderian's Panzer divisions to the Channel Coast in 1940, and General Patton's advance to the Loire in 1944—decided the Success of the German campaign in the West and the Allied invasion of Northern France ; *"assault from the air"*—Allied airborne operation at Arnhem-Nijmegen-Eindhoven—might, had it been successful (if the British 30th Corps could have moved up as planned), have shortened the war in Europe by a year. In Crete airborne assault was a prelude to a successful sea landing and the capture of a fiercely defended island. Once more it has been shown, however, that although new technical equipment, such as tanks, aircraft and parachutes, may give war a completely new face, it cannot lead to a decision unless it is backed up by that old standby, the infantry.

Thus airborne operations—at any rate against an enemy of anything approaching equal strength—can only have limited objectives. They are useful for winning a *foothold in the enemy's rear* in preparation for massed advances by ground forces or large-scale sea landings. They are also valuable for *surprise attacks* on military or industrial key positions far in the rear.

The equipment used for airborne operations has hitherto included parachutes, gliders and powered transports. These have now been joined by the helicopter, a newcomer to the air arsenal. Whereas parachutes and gliders leave the troops very little chance of retreat once they have landed, and powered transports need fairly extensive flat ground to land on, the helicopter is ideal for setting down an assault force rapidly at just the right spot . . . and then disappearing again when the mission is completed.

Helicopter infantry of the United States Marine Corps' 1st Division, a new type of soldier who received his baptism of fire in Korea on 18th September, 1951.

Baptism of fire in Korea

"Operation Summit": The helicopter was used for the first time in the fighting area on 18th September, 1951, in the occupation of a 2,900-foot hill on the Korean front. The operation was under the command of Lieutenant Colonel G. W. Herring of the United States Marine Corps. His helicopter squadron (HMR-161) of 21 Sikorsky S-55s[1] carried 224 Marines and eight tons of weapons, ammunition and supplies to the hill in four hours, after an assault squad had disembarked by means of knotted ropes to secure the position and clear two landing sites. Not a single man was wounded or a single helicopter damaged. It would have taken at least 48 hours to occupy the hill-top by traditional means.

"Operation MiG": An even more daring feat was performed by the crew of a single Sikorsky S-55 on 19th March, 1951, about 40 miles inland from the Korean coast.

The two pilots, Captain J. D. Cooper and Captain R. Winnegar, landed with an Office of Strategic Information officer and six Korean soldiers next to a crashed "North Korean" MiG-15 jet fighter, dismantled the aircraft (with hand grenades and special tools) and brought the MiG's engine, fuselage rear and tail unit safely home "for detailed inspection." Dismantling and loading took 45 minutes (with the helicopter's engine left idling) ; an escort of 50 fighters meanwhile guarded the skies above. Another MiG-15 was fished up by the Royal Navy from North Korean waters, so that the standard Russian fighter is now well known to Western staffs.

"Operation Rescue." Examples of rescue operations by helicopters in Korea are legion. Numberless wounded have been evacuated from the firing line, and pilots forced to bail out far in the enemy's rear have

[1] *Sikorsky S-55 data :* 600 h.p. Pratt & Whitney R-1340 engine, three-bladed rotor 53 ft. in diameter ; weight empty 4550 lbs. ; gross weight 6900 lbs. ; max speed 110 m.p.h. ; range 495 miles.

been safely picked up again. Here smaller helicopters, such as the Sikorsky S-51, Piasecki HRP-1 *Rescuer* and Bell H-13, are generally used.

The present and future of the helicopter

Helicopter operations are the particular hobby of the United States Marines. Under the National Security Act of 1947, the Marine Corps is responsible for tactical and technical developments in "amphibious warfare," i.e. combined land and naval operations. Since the advent of the atom bomb it has become too hazardous to concentrate ships and landing craft at any one point, but Marine Corps commanders feel that this drawback can be overcome by using helicopters from aircraft carriers. According to Lieutenant General C. B. Cates, of the Marine Corps, helicopters—together with fast aircraft carriers and troop-carrying submarines—will form the advance guard for amphibious units.

This is the assumption under which the Marine Corps has been training its elite forces for the past few years at its Quantico, Virginia, training centre.

Extensive combined landing exercises with landing craft, aircraft carriers and helicopters were held at Onslow Beach in the summer of 1952.[2] The production of new types of *large helicopter,* such as the 20-seat *Piasecki H-21* (first flight 1952) and 40-seat *Piasecki H-16* (first flight planned for 1953), should enable operations to be carried out on a grand scale not only by the Marine Corps but also by the American Army, which is extremely interested in both models.

The 20-seat *Piasecki H-21* (one 1425 h.p. Wright R-1820 engine), of traditional Piasecki design ("sagging sausage"), has two three-bladed rotors 44 ft. in diameter. Its maximum speed is 140 m.p.h. and normal range 600 miles. The 40-seat *Piasecki H-16* (two 1650 h.p. Pratt & Whitney R-2180-11 engines), has almost the same size fuselage as a *Convair-Liner,* plus a strong fin (to carry the aft rotor) and a high tricycle undercarriage, which enables heavy guns or trucks to be suspended beneath the fuselage. Civil versions of both these military types are planned.

Finally, for several years *Hughes Aircraft* has been working on a jet-powered *"flying crane"* helicopter (two General Electric J-35 turbojets), which is designed to carry the United States Army's heavy tanks across rivers and coastal waters[3]. The two-bladed rotor on this monster spans 120 ft.

Great Britain's latest commercial helicopters, the *Bristol 173 Mk.1 and 2* (15 seats ; two 545 h.p. Alvis *Leonides 73* engines) and *Bristol 173 Mk.3* (20 seats ; two 870 h.p. Alvis *Leonides Major* engines), are doubtless types which can also be converted into "assault troop transports." Saunders-Roe also have the giant three-rotor *Air Horse* (formerly Cierva W.11) under development for 26 to 34 men or freight. These helicopters could be used, in conjunction with British aircraft carriers and land bases, for commando or amphibious operations on a major scale. Then there is the five-seater Bristol 171 *Sycamore* which is used as a submarine spotter and ambulance.

*

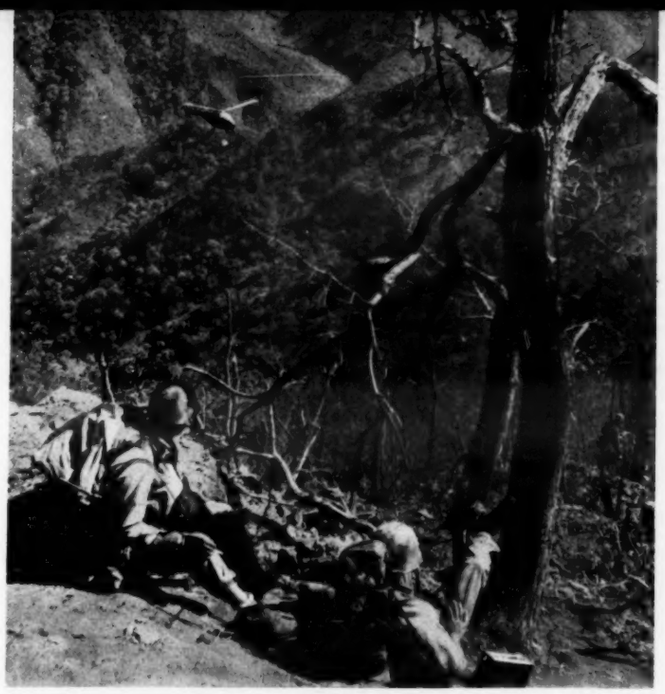
At the other end of the scale are the "buckle-on" *one-man helicopters* for the infantryman of the future (Pentecost *Hoppicopter,* Baumgärtl, Weihrauch.) This idea, however, seems hardly economical and has scarcely got beyond the "string and sealing wax" stage.

Fixed-wing transports

Will conventional powered aircraft be able to land and take off in the actual fighting area ? Generally not, except perhaps in desert warfare

[2] Cf. INTERAVIA, Review of World Aviation No. 10/1952, p. 606 ; No. 3/1951, p. 152, and No. 12/1952.

[3] Cf. INTERAVIA, Review of World Aviation, No. 3/1951, p. 137.



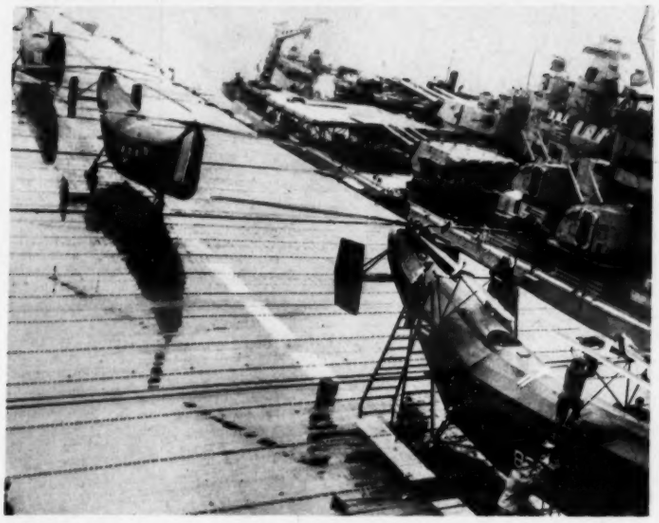
"Operation Summit": Once the men (224 Marines) had been landed, eight tons of supplies were carried in by means of nets. Duration of operation, four hours.

(like the German Afrika-Korps' Ju 52 transports) or in the broad plains of Asia. Improvisations are getting more and more difficult, however, since landing speeds and wheel loads of military transports have grown considerably during the past ten years. Modern transports as a rule require large airfields with concrete runways, which must be in friendly territory, at the very least in hedge-hog positions.

The German Panzer expert General *Guderian,* a genius of mobile warfare, therefore recommends the use of *multi-wheel landing gears or caterpillar track undercarriages on the model of tank tracks*[4], with which even large transports (e.g. the Fairchild C-119 or Blackburn & General Aircraft *Universal Freighter*) can land and take off in the most difficult country, either for airbone operations or for bringing up fuel supplies

[4] Generaloberst Heinz Guderian : "Gleiskettenfahrgestelle für Flugzeuge," (Caterpillar Track Undercarriages for Aircraft), *Wehr-Wissenschaftliche Rundschau* No. 5/1952.

Rescuing wounded Marines from the firing line in a Bell H-13.



Helicopters operating from aircraft carriers in "amphibious warfare" : Piasecki HRP-1 *Rescuer* on board the light aircraft carrier U.S.S. *Saipan* (14,500 tons).

The Piasecki HRP-1 *Rescuer* can carry a 75-mm field gun ; one minute after landing the gun is ready to fire.

to armoured spearheads and relieving encircled forces. On the subject of *Crete* Guderian writes :

"On the evening of the first day the situation by no means looked promising. It was impossible to send in the 5th Mountain Division, which was to be landed by transport aircraft, until we had an airfield in our hands. The extent to which airborne forces were dependent on a suitable airfield came clearly to light. It was not until Maleme airfield was captured that adequate forces could be brought up, on the second day of the attack, and British resistance broken. Up to this point, German casualties were heavy."

His views on Luftwaffe transport operations *in Russia* were as follows :

"The Luftwaffe had succeeded in supplying some 3,000 men in the Kholm pocket and even 100,000 men in the Domiansk pocket ; but it was to fail in the problem of supplying an army of 300,000 at Stalingrad.

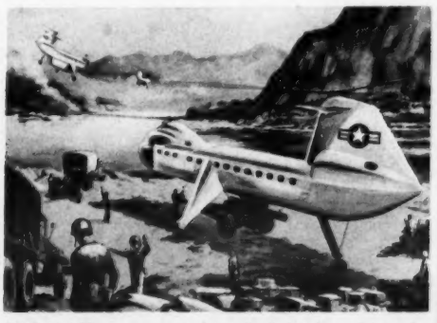
"A daily load of 200 to 600 tons of supplies of all kinds should have been flown into the pocket (of Stalingrad) by 320 aircraft . . . In fact, the daily average was 94.16 tons and the total 6391 tons . . . the landing grounds . . . were dominated by superior enemy air forces and very soon by the Russian artillery . . . Landing and taking off at these desolate fields became more and more hazardous as the weather deteriorated. Snow filled in craters and unevennesses in the ground, losses rose and the quantity of supplies flown in sank. This happened in spite of the fact that the ground was flat and offered no particular obstacles."

*

Nevertheless, an American Company, *Chase Aircraft Co. Inc.* (Trenton, N.J.), founded in 1943, has for years been working on a series of trackless troop transports, the C-122 and C-123, and has received substantial production orders for the latter from the U.S. Air Force. The USAF's assault transports represent to a certain extent the "long arm" of the long-range transports, as they can land and take off at *emergency strips right up in the forward fighting zone.* Their landing run is said to be no more than 200 yards.

Chase's latest creation, the C-123 all-metal high-wing monoplane with an unusally low undercarriage, can carry 60 fully-armed troops (or a 155-mm gun plus trucks). It is fitted with *two* 2120 h.p. Pratt & Whitney R-2800 *reciprocating engines* and, as the XC-123A, has also been equipped

1952–53 : The Piasecki H-21 *Work-Horse* carries 21 men and two pilots.



1953-54 : Heavy guns and trucks being brought up by the Piasecki H-16 helicopter.

The Hughes H-17 *flying crane* helicopter (jet-powered) is designed to carry heavy tanks across rivers and coastal waters.

The 15-to-20-seat Bristol 173 twin-engined commercial helicopter would also be suitable for commando operations.

A German design : Weihrauch one-man helicopter — a new type of pack for the infantryman.

Thanks to its robust construction and low landing speed, the Junkers Ju 52 could land even on poor ground. It carried reinforcements for the Afrika Korps' front line.

experimentally with *four* General Electric J-47 *jet engines,* of 5000 lbs. static thrust each, and brake parachute. Finally, the same type can be used as a glider tug or even—after removal of the engines—as a transport glider (type designation CG-20A). Span 110 ft.; wing area 1223 sq.ft. ; aspect ratio 9.9 ; weight empty (with reciprocating engines) 25,000 lbs. ; gross weight 54,000 lbs. ; max. speed 245 m.p.h. ; range 1160 miles.

*

The *Lockheed C-130 military transport,* a high-wing monoplane with a span of 132 ft., fitted with four 3800 s.h.p. Allison T-56 turboprops, follows similar design principles. Although also called an "assault transport" by its makers, this heavier and faster type will always require airfields.

Renaissance of transport gliders ?

The "transport gliders" which played an important part in the last war (cf. the article by E. Peter elsewhere in this issue) have today fallen into oblivion, for a variety of reasons :

— Gliders are "expendables," since once they are landed in wartime they can rarely take off again.

— Because of their immobility on the ground they clutter up the landing area for units arriving later.

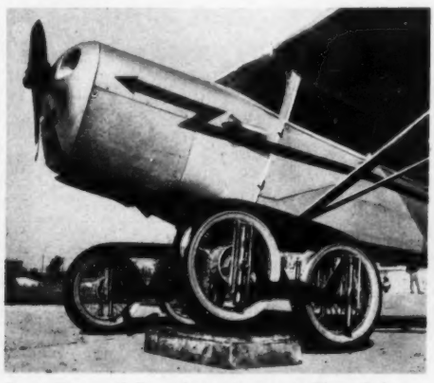
— Helicopters used on a "shuttle service" are more suitable for *coup de main* operations.

— Troop transports and flying crane helicopters operating from aircraft carriers are ideal for preparing sea landings.

Multi-wheel and caterpillar track undercarriages

are designed to make assault transports and artillery spotters independent of take-off and landing runs

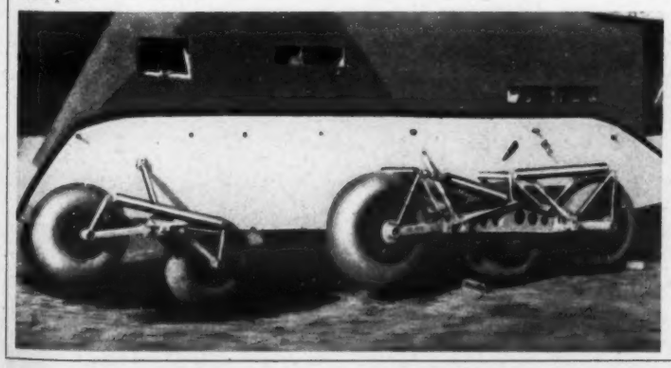
Nose-wheel caterpiller installation on a Fairchild C-82 *Packet.*



Count Bonmartini's undercarriage on a Piper *Cub.*

Piper L-21 artillery spotter with four-wheel undercarriage (civil version, *Super Cub 105*).

Ten-wheel cross-country undercarriage on the Messerschmitt Me 323 six-engined transport.



A Fairchild C-82 *Packet* can take off and land in the snow when fitted with a caterpillar track undercarriage.

The Chase XC-123 assault transport (two Pratt & Whitney R-2800 engines) for 60 men . . .

. . . can be converted into jet-powered XC 123A.

The same type can also be used as a transport glider (CG-20A).

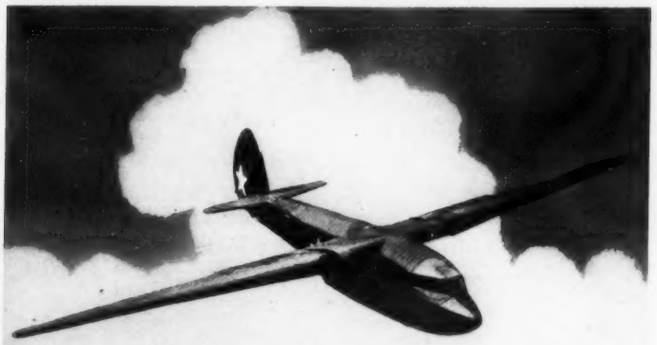
— Both West and East have efficient fleets of military transports and long-range commercial aircraft, and networks of air bases and airports (on their own or friendly territory) available for the mass transport of men and material.

Any major expenditure of equipment or personnel on glider units would thus scarcely be justifiable in these days of "hot peace" or "luke-warm war." Yet this cheap means of mass transport still seems to be regarded as having a certain future ; for the transport glider is by no means dead, as is shown by post-war developments in *Russia* (Tsibin KTs-20 ; Yakovlev ; Antonov), the *United States* (Chase CG-18A and CG-20A) and *France* (Castel-Mauboussin CM-10). *Russia in particular, having no operational helicopters, is reported to be paying attention to gliders.*

Vertical Warfare

In the event of a long major war, gliders may still have a role to play. With their wooden or mixed construction they are much cheaper than helicopters or powered transports, which would have a very short life in wartime, and they will still be a means of landing full units complete with heavy equipment at specific points.

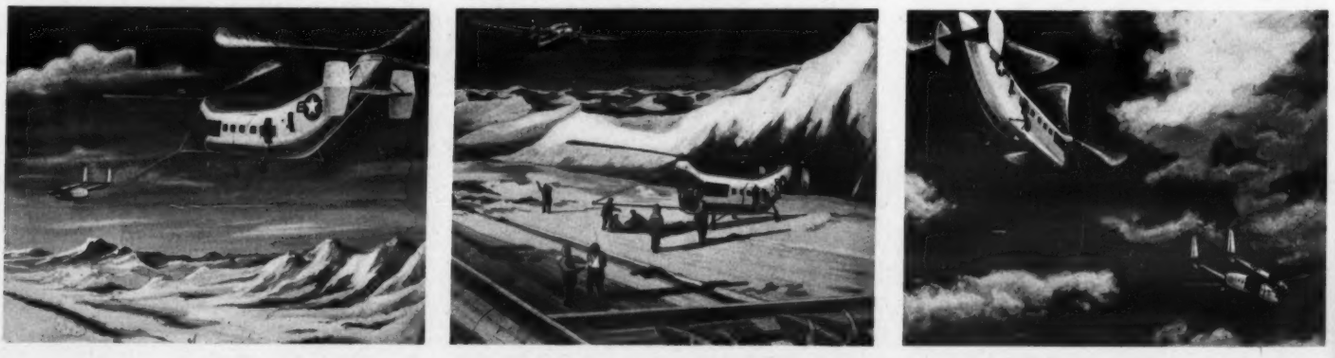
A final interesting point is that the helicopter, normally suitable for short ranges only, has learned from the glider and taken over its towing system. A powered transport tows it, with autorotating rotors, to the scene of operations, where it released, lands under its own power, carries out its mission and takes off on its return flight. Once in the air it is picked up again by means of trailing cables and towed back . . . as long as the "mother aircraft's" fuel holds out. At present this process is planned only for rescue missions, but it will probably also be useful for commando operations.



The Russian Antonov A-7 wooden glider. Span 62.3 ft., length 37.7 ft.

The French Castel-Mauboussin CM-10 wooden transport glider built by Fouga, for 35 men or two jeeps. Span 87.5 ft., wing area 774 sq.ft., gross weight 15,400 lbs.

The helicopter has learned from the glider. Here it is towed by a powered transport (Fairchild C-119) to the scene of operations, where it is released. Once its mission is completed, it takes off under its own power and is picked up again by the transport, by means of trailing cables.



Transport Glider Operations in World War II

BY ERNST PETER, BREGENZ

The Second World War, which demolished so many traditional military concepts, also wrought basic changes in the use of air power : aircraft were used for the first time to carry airborne troops. Admittedly, America's General "Billy" Mitchel had conceived a bold plan as early as 1918 to "climb over" the wall of Germany's western front, but the war ended before Allied preparations were complete.

Up to a few years before World War II opinions on whether and how airborne forces could be used were widely divergent. General Douhet did not give a single word to airborne troops or parachutists in his famous book on "Command of the Air" and Pierre Cot, French Air Minister at the time, spoke of them as a "circus stunt." On the other hand, both Russia and Germany were building up strong parachute forces.

In addition to ordinary transport aircraft, the belligerents used various types of unpowered gliders. These were first employed successfully by the Germans in the capture of Fort Eben Emael, near Liège (10th May, 1940). The Allied general staffs took over the idea and gave transport gliders an important part in the invasion of Northern France (6th June, 1944) and the crossing of the Rhine.

Technical development

The creators of the first transport glider were the well-known sailplane designer Jakobs and the *Deutsche Forschungsanstalt für Segelflug,* Darmstadt. The glider, designated the *DFS 230* (built in 1937), had a span of 69 ft. (20.9 m) and was a strutted shoulder wing monoplane of mixed construction. Behind the cockpit was a "cabin" for nine men who sat one behind the other on a narrow bench along the centre of the fuselage. The DFS 230 was also developed into a "*dive glider*" with a brake parachute attached to the tail, so that it could land at a steep angle in a very small space. It was towed by means of a 130-ft. cable 1/5 inch in diameter, to which an air-air R/T installation could be connected. Later this cable was replaced by a rigid bar about 13 ft. long, which made for smoother operation in formation or instrument flying. The tugs were usually multi-engined aircraft (e.g. Junkers Ju 52) which could tow two or three of these gliders on cables of different lengths. Normal towing speed was about 100 m.p.h. (180 km/h), maximum speed 220 m.p.h. (360 km/h) and lift/drag ratio of the normal version 11.

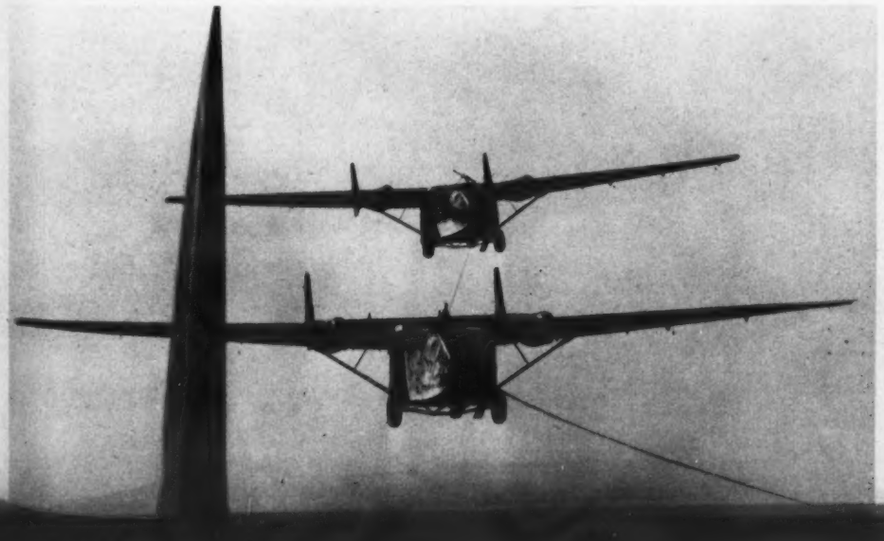
As wartime requirements increased it was decided in the summer of 1940 to build a larger transport glider, the *Gotha Go 242,* which was designed to carry 21 men. Span 79 ft. (24 m) ; gross weight 11,000 lbs. (5,000 kg) ; towing speed 125 m.p.h. (200 km/h) ; L/D ratio 9.

Giant transport gliders—the Junkers *Mammut* and Messerschmitt Me 321 *Gigant*—to carry armoured cars and heavy guns were built in readiness for the projected German invasion of England in the spring of 1941. The *Gigant,* a braced high-wing monoplane, had a steel tube structure (plywood and fabric cover). The fuselage was 93 ft. 4 ins. (28.5 m) long, 10 ft. 3 ins. (3.15 m) wide and 11 ft. (3.3 m) high, and thus had a volumetric capacity of 3,530 cu.ft. (100 m^3). The cargo hold which was reinforced by plates over a length of 36 ft. (11 m) had the same capacity as a railway box car. The cockpit (for two pilots) was in the upper part of the fuselage, about 16 ft. above ground level ; it was armour-plated on all sides and reached by a ladder inside the fuselage ; a sliding panel in the roof served as emergency exit. The landing gear comprised four skids, and the two nose-wheels and two main wheels on a single axle were used only for take off and were then jettisoned.

The Me 321 met the need for a machine to carry heavy or bulky supplies up to a total weight of 44,000 lbs. (20 tonnes)—or 200 men—by air. However, the tugs for these gliders continued to present a difficult problem, in spite of constant experiments. The first solution adopted was the so-called "Troika" towing system, using *three* Me 110 twin-engined fighters. This system demanded a high degree of flying skill from the powered aircraft pilots, who had to fly in close formation and were exposed to the constant pull on the tow-rope, the swinging of the glider, and the effects of gusts. Many pilots lost their lives during the tests, even before operations began.

My impression as a test pilot and leader of these towing trains was that the *take-off was*

German transport gliders (Go 242's) being towed in tandem.



The DFS 230 glider developed without publicity in 1937 (for a pilot and nine men) could make a steep spiral landing, using a brake parachute.

Two pilots and 21 men were carried by the Gotha GO 242.

Messerschmitt Me 321 *Gigant* transport glider being loaded with 20 tons of petrol.

the most difficult part. The *Gigant* was placed at the end of the runway—a concrete track at least 3,900 ft. long was required—and lifted on to the jettisonable undercarriage by mobile cranes, an operation which took at least half an hour. Next it was loaded, and the take-off rockets, 4 to 12 of them according to the load and the available space, were attached to the wings. Then the 2/5 in. thick tow-ropes were laid out, the centre one measuring 330 ft. (100 m) and the two others 264 ft. (80 m). (The tow-ropes could be released by the powered aircraft or by the *Gigant* either individually or together.) Revving up and taxiing by the tugs had to be carefully calculated. Frequently the port tug broke away owing to propeller torque, and it was by no means rare that the whole train broke up. These "Troika" trains were not only used in tests but were even employed operationally on the Eastern Front.

As the use of several tugs at a time was found to be too hazardous, it was decided to build a giant tug, which the Heinkel works rigged up by joining two twin-engined He 111's together and adding a fifth engine to the connecting wing panel. This was the origin of the *He 111 Z,* a weird but completely successful design which met all requirements for power, reliability and speed.

Flying the *Gigant* itself also demanded considerable skill. The first pilot did the steering, for which he needed terrific strength, while his "second" chiefly looked after trim and landing flaps. The gusts caused by the tugs' propeller slipstreams and the ups and downs of the air flow gave the *Gigant's* pilot a lot of trouble, let alone enemy attacks. After release the *Gigant* with its load of 44,000 lbs. glided down to earth at about 87 m.p.h. (140 km/h), at an angle of 1 : 8 and landed with a run of about 1,300 ft. (400 m).

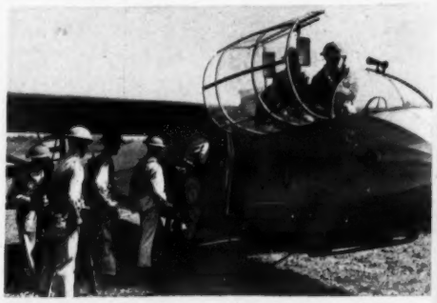
It should also be mentioned in passing that because of the urgent need for transports and because of the glider's immobility on the ground and its complicated take-off preparations, many German transport gliders were *fitted with engines* from 1942 onwards. For example the Messerschmitt Me 321 became the six-engined Me 323 (load capacity 31,000 lbs. = 14 tonnes ; crew : two pilots, one radio operator, two engineers, four gunners). Me 323's were used to supply the Tunisian front in 1943 and also in Russia, but in both cases they suffered heavy losses.

*

In the *United States* development of transport gliders was begun in 1941, chiefly by *Waco Aircraft Co.,* and later by *Laister-Kauffman.*

Built in large numbers (by Cessna, Commonwealth, Ford, Laister-Kauffman and others), the 15-seat *Waco CG-4a* (British name *Hadrian)* was a braced high-wing monoplane with a span of 83 ft. 8 ins. (25.5 m), a length of 48 ft. 3 3/4 ins. (14.7 m) and a gross weight of 9,000 lbs. (4 tonnes). Towing speed was 120 m.p.h. (200 km/h), minimum speed 38 m.p.h. (61 km/h) and L/D ratio 10. The year 1943 saw the development of the 42-seat *Waco CG.13a* (built under licence by Ford and Northwestern Aeronautical Corp.), and 1944 the 30-seat *Laister-Kauffman CG.10a (Trojan Horse).* The prototype of a 12-seat seaplane glider, the *LRA-1,* was built by Allied Aviation Corp. for the Navy, but was later dropped.

In *Great Britain* it was Major-General Browning, seconded by the well-known glider pilot Robert Kronfeld, who at an early date advocated the use of the transport glider. *General Aircraft,* of Feltham, built the *Hotspur* with a span of 45 ft. 10 3/4 ins. (14 m) and a gross weight of 3,635 lbs. (1650 kg), which could carry two pilots and six men. Towing speed was 150 m.p.h. (240 km/h) and gliding speed 80 to 170 m.p.h. (130 to 270 km/h). It was later developed into the twin-fuselage *Twin Hotspur* for 2×8 men. Another British transport glider, the *Airspeed A. S.51 Horsa,* was chosen in 1943 as standard type for the British glider divisions. (Highwing monoplane of wooden construction ; span 88 ft. = 26.8 m ; gross weight 15,500 lbs. = 7 tonnes). The circular-section fuselage had room for 15 fully-armed soldiers.



Waco CG-3a, an American glider for two pilots and seven men.

Finally, there was the *General Aircraft Hamilcar I* glider, designed for the invasion of northern France. It had a load capacity of 17,600 lbs. (7.9 tonnes), a wing area of 1,657.5 sq.ft. (154 m²) and a gliding speed of 75 to

A Messerschmitt Me 323 six-engined transport loading a heavy field gun.

187 m.p.h. (120 to 300 km/h). The freight hold of this high-wing monoplane had a cubic capacity of 1450 cu.ft. (41 m^3) and could be loaded and unloaded rapidly through large nose doors, without loading ramp.

A new feature was its hydraulic sprung legs which, when a valve was opened, allowed the glider to sink down until its fuselage rested on the ground.

The pilot's cockpit in the Waco CG-4a, the Americans' standard glider (for two pilots and 13 men), could be lifted up.

*

Striking progress was thus made as the war advanced. Flying performance was improved (higher towing speed, lower landing speed), loading and unloading speeded up and landing simplified. Even more telling improvements were made with the introduction of *rigid towing* (Germany) and the *cable angle indicator* (Britain) *for night and bad weather operations.* Before the end of the war it was possible to use the transport glider everywhere and in all weathers, to get whole tow trains off the ground within half a minute and even to organize mass take-offs by large units in a very short time.

Transport glider operations

First reports on the use of paratroops came to Germany before the war from Russia, the United States, Britain and France. At that time Germany held a leading position in sailplane construction and soon came upon the idea of using airborne troops in "noiseless" gliders. A handful of Luftwaffe officers and glider pilots began to try out this idea on a broader basis in 1937, and by the outbreak of war there were quite a respectable number of trained "glider people." The secret was jealously guarded from the outside world. Personnel consisted of volunteers, trained with the 7th Air Division in Berlin and grouped together with the parachutists to form the *11th Air Corps* under General Student.

The glider units received their baptism of fire on 10th May 1940, during the operations against Fort *Eben Emael.* The Belgians were taken completely by surprise, and as the Germans at that time enjoyed air superiority, gliders could be towed safely to the target and ground defences contained, both essential conditions if landing is to be smooth. The gliders approached in a steep spiral and landed with the aid of brake parachutes. The crews then fought a way clear for the parachutists who followed after. This first operation showed the extraordinary value of airborne troops, but also revealed certain weaknesses.

Other airborne operations followed. The *Balkans campaign of 1941* offered an ideal opportunity for the use of airborne forces along the Corinth Canal. But Germany's biggest operation of this kind was attempted in *Crete.*

On 20th May, 1941—for the first time in the history of war—a "*Luftwaffe* headquarters" carried through an operation in which all three services, Navy, Army and Air Force, took part—though a major proportion of the forces used were parachutists and airborne troops. Although the island was ultimately captured, the operation did not at all run to programme. It had been planned to support the airborne attack with a simultaneous sea landing by an Alpine division. Glider crews and parachutists were to capture the airfields at Maleme, Retimo and Heraklion, the way having previously been prepared for them by bombing. As soon as these fields had been taken, powered transports were to land at Maleme.

However, the glider crews suffered much heavier casualties than had been expected because of the difficult terrain and unexpectedly strong opposition. They were unable to complete their task—the capture of the landing zone—and were forced on to the defensive. Co-operation between parachutists and bomber units broke down, because the formers' departure from their poor air bases in Greece was delayed (above all by dust clouds). The bombers therefore had already done their work and were on their way back when the parachutists arrived on the scene. Heavy losses were the result. The powered transports, scheduled to land at Maleme, met with strong resistance as the area was not entirely in German hands. On top of all this, the ships coming from Piraeus were attacked by British Naval forces and almost all destroyed. It was only because the Germans with their mastery of the air were able to disperse the British Naval unit by successive air attacks, and thus clear the way for a second German seaborne force to cross at the last moment, that the attack on Crete was finally successful.

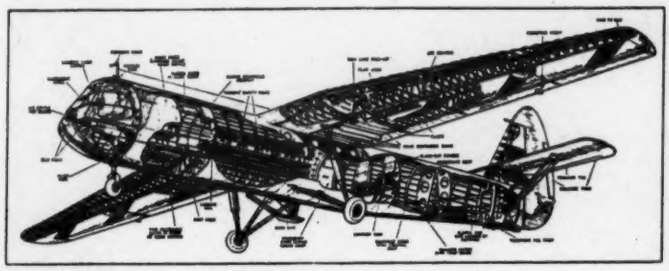
After Crete the Germans never again employed transport gliders for large-scale combat operations, though they were often used for *supply purposes.*

On the *Eastern front* in particular, airborne supplies were of vital assistance to the fighting troops. Large numbers of DFS 230's and Go 242's were used to bring up men and material. *Four squadrons of Me 321's* (with the *Troika* towing system) were moved in the spring of 1942 to the Riga—Orsha area from which they were used to occupy the island of Oesel and to carry supplies to the German armoured spearheads in the central sector.

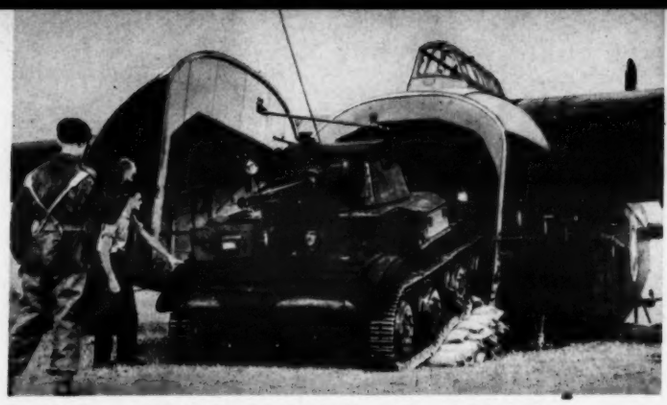
During the summer of 1942 massed transport units assembled in the Southern sector of the front for the advance into the *Caucasus* and to the *Don.* Here *He 111 tug squadrons towing Go 242's with rigid tow bars* were used for the first time, so that flying could continue in all weathers. So-called *"Sanitäts-Go,"* equipped as ambulance aircraft, were towed right up to field dressing stations; and *workshop gliders* of the same type brought up technical supplies for front-line airstrips.

Laister-Kauffman CG-10a *Trojan Horse,* a large American glider for 30 men.

Britain's General Aircraft *Hotspur* transport glider: two pilots and six men.



Airspeed *Horsa* glider : two pilots and 15 men.



Britain's General Aircraft *Hamilcar I* unloading a *Tetrarch* light tank.

When land communications with the Crimean peninsula were cut (1st November, 1943), the Crimea had to be supplied across the Black Sea from the Odessa area. Here too Go 242's were used, and again in the subsequent evacuation of the Crimea. Encircled bases, such as *Kholm, Tarropol, Velikye Luki,* the city of *Budapest* (winter 1944), and finally *Breslau* (March 1945) were supplied by powered transports and gliders. An example of smaller operations is the rescue of Mussolini by German gliders and a handful of parachutists which made a surprise landing on the Gran Sasso.

*

On the *Allied side* a first British glider regiment was created as an experiment at the end of 1941. Next, two British airborne divisions were formed, each consisting of one glider brigade and two parachute brigades. Once the flying equipment (airspeed *Horsas*) was available training started at the end of 1942.

The tactics of the Allied airborne forces were the exact opposite of the German tactics. The Allies concluded from the heavy losses among glider crews in Crete that it was better to drop the parachutists *before* the gliders landed. Special formations of parachutists were therefore trained, with the idea that they should break the enemy's first resistance and help the gliders to land.

The *invasion of Sicily* (10th July, 1943) brought the first large scale use of Allied transport gliders. Large numbers of parachutists had been arriving in North Africa since November 1942. *Horsas* and *Hadrians* were flown out to Africa from Britain in eight hours. However, it was found that the all-wood *Horsas* were not equal to the African climate, and only the *Hadrians* of mixed construction could be used. After ample softening-up by bombing, British and American paratroops and gliders set off in large numbers, despite bad weather conditions. The pilots lacked operational experience, and losses were consequently high. Gliders frequently failed to reach their target areas, landed among the enemy, and on top of this were fired on in error by American anti-aircraft defences.

For the *invasion of Normandy* six allied airborne divisions were prepared in Southern England. Their employment had a decisive effect on the outcome of the battle. The invasion was preceded by heavy bombing. The parachutists were sent in first during the night of 5th June 1944 to take tactically important points ; the gliders followed at dawn. The two operations were well co-ordinated, and losses were smaller than expected. The Germans were taken completely by surprise, for the landing was made in bad weather. Of course the Allies' absolute mastery of the air contributed greatly to the success of the operation. The British were thus able to establish a bridgehead in the Caen area, and the Americans at Sainte-Mère-Eglise. Later glider waves brought up anti-tank artillery, armoured vehicles, jeeps and men in a continuous stream. The following glider types were used : Airspeed *Horsa* (25 men plus equipment, or a 37-mm gun and 7 men) ; Waco *Hadrian* (15 men or a 75-mm howitzer and 3 men) ; General Aircraft *Hamilcar* (a Tetrarch IV seven-ton light tank and a 37-mm gun). Altogether 860 transport gliders were used.

However, the next allied large-scale operation, at *Arnhem,* was a costly failure (cf. article by General Pickert).

The 25th March 1945 saw the largest airborne operation mounted up to that time, when over 40,000 men were landed from the air on the *Lower Rhine, near Wesel.*

Eight thousand Allied bombers, fighter bombers and transports and 1300 gliders set out. German anti-aircraft position and supply routes were plastered with bombs ; the Luftwaffe could offer virtually no resistance. The glider units had sustained heavy losses at Arnhem, and their ranks had to be made up for this new operation by hastily-trained personnel whose lack of fighting experience led to serious losses after landing. However, the operation was accounted a complete success, particularly as the Allied Army group following up on the ground was able to relieve the airborne troops within a day.

Smaller Allied airborne operations (e.g. *Dieppe* and *Saint-Nazaire*) had previously been carried out above all to gain experience for the big invasion, or to destroy German radar stations and special weapons. Allied parachute troops and gliders were also used in *Norway* and in *Yugoslavia* to supply and reinforce the partisans.

Future uses

Experience of the last war clearly proved the value of transport gliders, and some improvements have been made since. For example, a method of getting gliders back to base after landing has been tested. The tug aircraft in flight picks up the tow-rope laid out on the ground and draws the glider up after it. Previously any glider landed in battle had to be written off as lost.

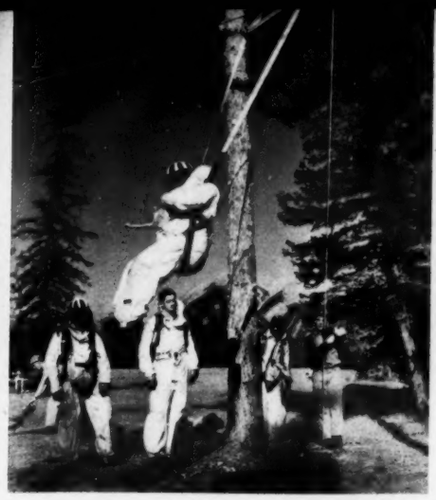
The glider's chief advantages are its low production cost and its ability to make surprise attacks and to land accurately within a very small area. It could thus still be valuable, for example, against enemy key positions, to enclose powerful forces, break through rigid fronts, relieve friendly troops, etc. Finally, "noiseless" gliders are useful for night *coups,* for setting down sabotage squads and agents.

A vital requirement for all large-scale operations, however, is air superiority. The lack of heavy weapons and armoured vehicles makes itself felt most strongly at the beginning of a ground battle and must be compensated by air support. A permanent air umbrella is also essential to protect supply routes.

To carry troops by air is the quickest way to get them into battle at the decisive point. Fighting spirit, resolution, physical fitness and ability to handle any weapons (including captured enemy weapons) are essential to success. Finally, airborne troops must have explosives, flame-throwers, anti-tank rockets, light machine guns, etc.: hence, the tendency towards equipping airborne forces with their own tanks and vehicles and their own artillery.

Thus, although very heavy loads, such as vehicles and howitzers, can be dropped by parachute ; although helicopters have been greatly improved and the landing runs of giant transports have been reduced, *the transport glider may still have its uses.*

"Paramedics" and "Paranurses"



The first seven weeks of the RCAF's parachute medical training course are spent at Edmonton, Alberta, after which pupils move to the parachute school at Jasper, Alberta. Emphasis is placed on the proper method of landing by parachute, and simulated landings are performed on the "swing" (above) to teach students to land with feet together, knees bent, arms crossed and head down.

The introduction of "vertical warfare" has automatically created the need for medical and nursing personnel to attend to the heavy casualties which usually result from strikes by parachutes and other forms of airborne assault.

Many countries have therefore begun training female nurses and male medical personnel in the technique of parachuting into areas where they are needed.

The Americans, who cannot resist coining new terms for anything that normally requires two words, have already called these men and women "paramedics" and "paranurses." An idea of how the Royal Canadian Air Force trains medical personnel in its parachuting functions can be gleaned from the photos on this page.

Contact! As the student commences his "roll" on the ground to prevent possible injury, the shroud lines of the parachute "break." Controlled descent plays an important part in the training, for by learning to manipulate his shroud lines the "paramedic" can land very close to the spot selected (black circle). Once a jumper has mastered the correct technique, he can land in rugged country and even in trees without injury.

A nursing sister holding the rank of Flying Officer practices the proper technique of leaving small aircraft when jumping. The machine is a Noorduyn "Norseman."

All aboard for a practice jump! Dressed like men from Mars, three nurses are assisted into the "Norseman" by an instructor.

Elementary signalling is part of the training given to parachute medical personnel. Here a nurse is using a signal mirror.

A group of nurses ready for a jump. Pilot Officer Marion Neily, first from left, was the first Canadian nurse to parachute into space. In their hands the nurses hold their helmets, provided with detachable screens to protect them against facial injury upon landing.

A student makes a practice jump at Henry House Field, near Jasper, Alberta.

Safely on the ground again. Three "paramedics" and "paranurse" Neily have just made a jump as a complete medical team.

Lunch in Casablanca or An Afternoon in Nice

BY GEORGES FÉVRIER

"Paris by Night . . . See Versailles and its Château . . . A day in Fontainebleau . . ." The classic invitations outside Paris travel agencies will soon be completely out of date. Even now they could be replaced by *"Lunch in Casablanca"* or *"Six hours in Nice."* Thanks to Union Aéromaritime de Transport's *Comet* and Pan American Airways' DC-6B, I made both these tours, at an interval of only two days.

If, in Casablanca, I did not explore the Arab streets leading off the Place de France or visit the five thousand "fair ladies" of the Bousbir district, this was because I preferred the peace and the magnificent view at the Anfa Hotel. And if in Nice I neglected the Promenade des Anglais, the roulette tables at the Palais de la Méditerranée and the flower market, it was in order to enjoy the *"Réserve de Beaulieu"* with its swimming pool . . . and its fine food.

Still, these two day trips—or almost, as I shall tell you in a moment—did give time for real tourist visits to the two towns.

And in my opinion there is nothing which illustrates more vividly the tremendous strides made by air transport.

*

Three minutes after its jets had started up, UAT's *Comet* took off into the grey sky above Le Bourget, carrying 44 passengers and a double crew.

Another three minutes later we had thrust through the cloud layer into the sunshine.

And we went on climbing. One of the *Comet's* peculiarities on medium runs is that it never flies level. The pilot sets his cruising output at 32,000, 24,000 or 36,000 feet, according to the stage length, but continues to climb up to 42,000, 44,000 or even 46,000 feet in order to keep his air speed indicator constant. And then . . . he comes down again.

*

The pure white, unbroken cloud layer 30,000 feet below looked like a vast field of snow furrowed by ski tracks. The sky was deep blue, and the wing reflecting it looked black, despite its shiny new metal.

"Where are we ?" I asked Combard, UAT's Joint Managing Director. Laughing—he is proud and happy to have succeeded, with his friend Loubry, in making his company the first Continental airline to use jet aircraft—he replied : "Let's see if the navigator happens to know."

The answer was immediate : right above Madrid. We had flown from Bordeaux to the Spanish capital at 520 m.p.h.

*

Less than three hours after taking off—to be exact 2 hours and 43 minutes later—the *Comet* touched down on the immense Franco-American base of Nouaceur.

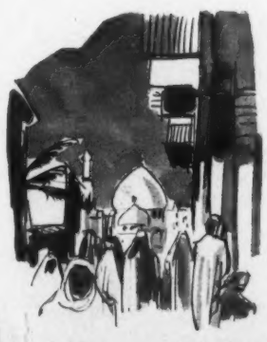
Thirty-four years ago, on August 11th, 1919, when Lucien Coupet and Lucien Bossoutrot made the first flight from Paris to Casablanca, their twin-engined Farman *Goliath* took 18 hours 23 minutes for the trip.

The *Comet* flies seven times faster.

But in those days a Metro ticket cost only 15 centimes. Now it costs 30 francs. Aircraft may fly faster and faster, but they never catch up with the cost of living.

*

Nouaceur with its great 10,000-ft. runway, its two control towers—one American, one French—recalls the visions of the Apocalypse. Trucks with engine trouble are towed by camels, and Arabs drive bulldozers. Native huts and tents line the taxi-ways, and veiled Berber women watch the GI's as they pass.



French, English, Arabic are heard . . . Let's also have the Dutch and the Scandinavians.

Why two control towers ? Why not a single tower . . . of Babel ?

*

On the Paris—Casablanca run the *Comet* beats the best of the conventional aircraft by a good hour and a quarter. But the bus trip into town hasn't gained a single minute (this is one of the headaches of commercial aviation). And when we took off again night was not far off.

Above the clouds, which reappeared when we reached Spain, the sky was of miraculous splendour. Soon night came, blue, then blue-black, then a deep black ; a sky of intense purity, with stars brighter than I have ever seen them, and a slender crescent moon.

The picture vividly recalls Hugo's lines :

" . . . what toil-worn reaper in an age-long summer leaving his swathe, and parting, so wantonly did shy his golden sickle into the star-filled sky."

As we left Nouaceur the weather men had given us the classic forecast, always so well received: "Storms in a blue sky at 40,000 feet."

They didn't realise how right they were. I don't know whether they are called jet streams or clear air gusts, but I do know that it is rather surprising for a 44-ton aircraft to be thrown about, like a cork in a rough sea, by turbulence of indescribable violence in a perfectly clear sky—the clouds were about 25,000 feet below us.

And when the aircraft is flying at 500 m.p.h., believe me the impression created is not a happy one.

This extraordinary dance, which the meteorologists had predicted, but which still cannot be either foreseen or avoided, occurred only twice and for two minutes at a time, but by an unlucky chance just when tea was being served. The hostess was just taking her tray from the lower hatchway when the door to the upper hatch fell down on her head.

These hatches are an unpleasant booby-trap.

Fortunately de Havillands had not built them on the standard English guillotine system.

*

Before landing I paid a visit to the crew. In the ghostly light of the cabin—where the instruments, however, are perfectly lit—you would have sworn they were a group of Martians escaped from a Wellsian novel.

Here are no gilt-trimmed caps, no bare heads. Canvas helmets are compulsory, so that oxygen masks are always within reach.

*

Two days later, when three buses and several private cars took the 92 people to Orly who were to visit Nice in PAA's DC-6B "Liberty Bell," it was still raining. Such is winter in Paris. Should we find sunshine on the Riviera, as we had in Morocco ?

We found it as soon as we had finished our half-hour climb.

With nearly a hundred occupants, the DC-6B looks much more like a railway coach than an aircraft cabin. Every possible inch of space has been set aside for passengers ; the wash-rooms are hardly big enough to turn round in, and the crew's cabin—with two seats for the pilot and co-pilot and a bench between them for the engineer—was certainly not designed for dancing the boogy-woogy.

The DC-6B is a money-maker. Its whole space is devoted to those who pay.

*

Two hours in the air. We scarcely had time to say hello to Mont Blanc before we arrived over the Riviera, which the pilot, Captain Watkins, was visiting for the first time.

I showed him Saint-Raphaël, the red rocks of Agay, Cannes surrounded by yachts . . .

We by-passed Nice to have a look at Monte Carlo, then, after a brief glimpse of San Remo, turned back to land at Nice's airport of La Californie.

*

I mentioned earlier that each of these trips had taken one day, or almost . . . I should explain. When the Brazilians talk about the future they say "Si Deus Quizer." When the Anglo-Saxons give an aircraft's time of arrival they add "weather permitting."

Visibility was perfect : we could see the Alps and the Massif Central. Yet Orly and Le Bourget were closed, and we had to return to Nice. Once on the ground, our troubles began. How, at eight o'clock in the evening during the Carnival season, to find 92 rooms, 92 tooth brushes, 92 tubes of tooth-paste and send 92 messages (or a few more, since some of the passengers wanted to notify not only their wives but their girl friends as well).

The problem was solved admirably by PAA's Nice agency. And when, at midnight, Madame Berthe Pourrières finally found the last eight tooth brushes, she could justly feel satisfied with her efforts.

Satisfied is the word to describe all of us—except one. His wife didn't like him to fly, so he had told her he was going to Cherbourg to inspect a ship.

Her reaction when he telephoned from Nice nearly blew up the telephone booth.

*

Our return flight was as fast as the outward trip, but seemed shorter. We passed the time by playing a game—through the public address system, the best I have ever heard in an aircraft—recommended for landings in bad weather.

Everyone draws a number, from 0 to 60. If the aircraft touches down at 39 minutes past the hour, for instance, the holder of this number is the winner.

I had 27. At 13.26 we could see the runway at Orly. At 13.27 our wheels touched the concrete. And I got ready to receive the bottle of whisky promised by Dave Yandle. Alas, my watch was one minute fast by the aircraft clock.

But do I care really ? I don't like bourbon . . . like the grapes, it is too sour.

As a rule nobody comes to meet passengers after such a short trip. But there was one lady outside the air station, hiding something behind her back. A bunch of flowers, perhaps . . . or a rolling pin ?

I haven't seen the man who was going "to see a ship at Cherbourg" since . . .

A plastic balloon, named "Moby Dick," is released at Holloman AFB, Alamogordo, New Mexico. As it gains height, the gas inside the envelope expands, filling it.

What's it like at 100,000 feet?

The Air Research and Development Command of the U.S. Air Force has started using plastic balloons to carry research equipment to altitudes between 50,000 ft. and 100,000 ft. to acquire new upper air data for present and future operations at increasingly highter altitudes favourable for faster flying speeds. The equipment, weighing 100 to 400 lbs., is detached from the balloon automatically at the selected height and returned to the ground via parachute. A card attached to it requests finders to return it to the USAF. —all expenses paid. The USAF in fact pays not only the postage but also the expenses of a telegram to the air base responsible. In addition, the finder gets a reward of $25.00 if he signs a declaration to the effect that he "agrees to accept the reward"! Finally, he may keep the parachute (Nylon, excellent for ladies' unmentionables . . .).

NOTICE TO FINDER

THIS EQUIPMENT IS NOT DANGEROUS

IT IS THE PROPERTY OF THE U.S. AIR FORCE
AND WAS CARRIED ALOFT BY A LARGE PLASTIC BALLOON
TO OBTAIN HIGH ALTITUDE WEATHER INFORMATION.

RECOVERY OF THIS EQUIPMENT IS IMPORTANT!

PLEASE FOLLOW THESE INSTRUCTIONS:

1. 2. 3.

THANK YOU - YOUR $25.00 CHECK WILL BE MAILED TO YOU AS SOON AS WE RECEIVE THIS BOX.

NOTICE TO RAILWAY EXPRESS AGENT:

SHIP COLLECT TO—
COMMANDING OFFICER
E. AND A. SECTION
HOLLOMAN AIR FORCE BASE
NEW MEXICO

(ATTACH COLLECT BILL HERE)

+44570AC

Instructions to the finder.

Eisenhower Cabinet Promises Strong Air Power

BY CHRIS ROBERTS, WASHINGTON

It was only after much delay that President Eisenhower's team of Department of Defense officers was confirmed by the U.S. Senate. The delay was created by the Eisenhower philosophy of appointing exceptionally successful business men to the top posts in his Cabinet. Sound as this philosophy may be, it ran head-on into an ancient principle of U.S. government which forbids a man to acquire personal gain from his public office.

Without exception, the men Eisenhower nominated for top posts in his administration are wealthy in investments, many of which lie in companies with which the government does and will continue to do business. For this reason, the Senate insisted that these men divest themselves of their holdings as a prerequisite of confirmation to their posts. The Defense team, led by Charles E. Wilson, underwent protracted thought before agreeing to this requirement since, *per se,* it implies suspicion of motive. The sale of substantial holdings resulted in huge tax payments (and, therefore, losses) by the individuals involved, so that the Eisenhower Defense team assumed their respective offices undeniably at great personal sacrifice.

*

Charles Erwin Wilson, the Secretary of Defense, was top man in the nation's biggest business: General Motors Corporation. Thus, he brings to the Pentagon an unparalleled experience in the organization and administration of "bigness," and the Department of Defense is the biggest business in the world. But Wilson will find a monumental difference in running the two establishments: the Department of Defense is tied by red tape from one end to the other through laws, regulations and ordinances over which he will have no control. Whether Wilson manages to change these, work effectively in spite of them, or is mastered by them in the end only time will tell. But his first task is to attempt a thorough overhaul of the strange anomaly of the Department of Defense, an office built on an uneasy truce between three warring factions: the Army, the Navy and the Air Force.

Charles E. Wilson, the new Secretary of Defense. "Engine Charlie" formerly was, as President of General Motors Corp., top man of America's biggest business. Now, as the head of the biggest business in the world, his task is to introduce efficient business methods into its operation.

It may be safely assumed that Wilson agreed to the job only on Eisenhower's firm assurance that Wilson would have unhampered authority to run the Department. This he does not now have. The National Security Act of 1947, as amended in 1949 and in 1952, defines the Secretary of Defense as "the principal assistant to the President" in defense matters and grants him "direction, authority and control" over the Department. The Act, however, then proceeds to retreat from this grandiose statement. It expressly forbids the Secretary from having a military staff, from changing the combat functions assigned specifically to the various military services, and from direction of any of the military commands in the field.

Directly athwart the Secretary's powers stands the *Joint Chiefs of Staff,* an utterly impossible arrangement in which the chiefs of staff of the separate services theoretically deal with strategic and budgetary matters at a non-partisan level. Directing their deliberations is a Chairman, General Omar N. Bradley, who has no vote in their proceedings!

Upon leaving his post, former Secretary Robert Lovett broke his long, characteristic silence and stated flatly that the only conceivable solution to the situation lay in making the Secretary incontestable boss of the Joint Chiefs of Staff and, further, relieving these officers as active directing heads of their own Services. *This means, in brief, the creation of a modern equivalent in the U.S. of the historic German General Staff.* The parallel, as proposed, is complete. The proposal would include staff officers selected according to a separate General Staff promotion list, the members of the General Staff would be completely divorced from their respective Services, would work in an assumed atmosphere of non-partisanship and, it seems inevitable, would all have five-star rank (equivalent to Field Marshal) and, perhaps, distinctive uniforms.

Such a proposal seems preposterous in the modern United States. The probable course to be followed will veer 180 degrees from the one proposed and may eventually result in complete dissolution of the Joint Chiefs of Staff idea, the function being transferred directly into the Office of the Secretary of Defense, who would provide himself with a military staff. Such a move, of course, would require specific changes in the law and would be accompanied by violent objections of the three Services.

However, it seems the only practical solution to the problem. During the past two years the Joint Chiefs of Staff have considered and approved some 1600 separate matters (or an average of 3 ½ hours deliberation on each!). Of this total, only 600 dealt with strategic matters, the sole purpose for existence of the JCS. The remaining 1000 were either purely administrative or partly so, all of which are clearly functions more logically handled by the Secretary and his administrative staff.

Charles Wilson will be a strong man in the Department of Defense. He has been an executive in American competitive business for 40 years, and such men are used to thinking a problem through clearly—then taking direct and unequivocal action. Wilson's habits will not change and it is certain that his first order

General Omar N. Bradley, Chairman of the Joint Chiefs of Staff. The authority of JCS is likely to become a cause of conflict with the new U.S. Defense Department head.

Robert A. Lovett, last Secretary of Defense under the Democratic Administration, has suggested the creation of a U.S. equivalent of the historic German General Staff. The proposal is unlikely to be adopted.

of business is to "straighten out the mess" of tangled authority and legislative handcuffs he faces.

*

One of the last officers in the new Eisenhower cabinet to receive approval was that of *Harold E. Talbott* as *Secretary of Air Force.* Talbott's confirmation was delayed because he delayed longest in agreeing to divest himself of various investments, including major holdings in Chrysler Corp., Electric Auto-Lite, Standard Packaging, Baldwin-Lima-Hamilton Co. and others, all contractors to the U.S. Government. Compounding this delay, however, was the curious fact that Talbott has had a long career in the aviation business. During World War I Talbott's father, Harry Talbott, and Charles F. Kettering, formed the Dayton-Wright Co. to manufacture planes designed by Orville Wright in Dayton, Ohio. Harold Talbott was made president of the company, although owing to his youth all major decisions were made by his father.

The company received a contract for the production of the de Havilland DH-4, of which they built several thousands. It was later charged that Colonel E. A. Deeds, Army contracting officer, was secretly an officer of the company, and court martial proceedings were instituted (but later dropped). A postwar investigation condemned the company's products as "flying coffins" (actually a criticism of the design rather than the company's manufacture of them—although this point escaped the Senate Armed Services Committee which recently considered Talbott's nomination !). The government filed a claim for $2,500,000 against the Dayton-Wright Co. in 1922, but the U.S. Circuit Court of Appeals held in the company's favour. Thus, Deeds was not court martialed and the Dayton-Wright Co. did not have to return any money to the government, but the story had just enough controversy in it to delight the Senators and force its complete recital about thirty years later !

Talbott's aviation career continued unabated and he became Chairman of the Board of North American Aviation Corp. in 1929. During World War II he served as Director of the Aircraft War Production Board. Thus, with this background he brings to the post of Secretary of the Air Force long experience in the financial management and the scheduling of aircraft production. He is a steady, deliberate man without personal warmth but with outstanding executive ability, not only in taking orders from above but in working harmoniously with subordinates.

Harold E. Talbott, the new U.S. Air Force Secretary, has had a long career in aviation. He served as Director of the Aircraft War Production Board during World War II.

*

For *Under-Secretary of the Air Force,* Eisenhower had nominated Robert C. Sprague, President of the Sprague Electric Co. in Massachusetts. However, Sprague declined the appointment, as he was unwilling to sell his $5,000,000 holding in the family-owned electronics firm.

H. Lee White *(right)* being sworn in as Assistant Secretary of the Air Force by Secretary Talbott. White formerly was a partner in the New York law firm of Cadwalader, Wickersham and Taft, and a Commander in the Navy during World War II.

Two weeks after this decision, President Eisenhower nominated *James H. Douglas,* 53, as USAF Under-Secretary. Douglas is a wealthy attorney of Lake Forest, Ill., and holds directorates in a number of corporations, including American Airlines. During World War II, Douglas at one time was Chief of Staff to Air Transport Command of the U.S. Army Air Forces with the rank of Colonel.

At this writing, his appointment has not yet been confirmed by the Senate, but there seems no reason why the Senate should withold its approval—provided Douglas is willing to sell the financial interests he has in corporations working for the U.S. Government.

H. Lee White, New York lawyer, has been nominated *Assistant Secretary* of the Air Force and was formerly a Commander in the U.S. Navy. *Assistant Secretary of the Navy for Air, John Floberg,* also formerly a Navy Commander, has been selected to remain in his post. This accent on Navy men poses a natural question, but this has been dismissed as mere coincidence insofar as they were chosen from the ranks of successful businessmen purely for their administrative abilities (which might be another argument for enlistment in the Navy !).

Thus, the new Defense team follows rigorously the Republican Party and the Eisenhower accent on big businessmen as defining ableness and on proved private ability to administer large enterprises with economy and efficiency. *All of these men, however, will need Eisenhower's help in eliminating the near-hopeless tangle of red-tape in their offices, and the President, in turn, must lean heavily on Senator Robert Taft and his Republican majority to provide the law changes required.*

With their backgrounds and business habits as a guide, it is clear that the new Eisenhower Defense team will bring a radical new emphasis on efficiency and economy in the business of providing the U.S. with Air Power and national defense. All the new men are personally "sold" on Air Power as the dominant arm of defense, and the presence of the team can mean nothing but good for the aircraft manufacturing industry. They will mean more streamlined business-like methods.

*

However, overshadowing this promising new philosophy is the new Administration's dedication to a *reduced budget and more economy in government.* This will come first—and Eisenhower has already made major moves in this direction. It means that Defense spending will not only be held to its present level, but reduced as sharply as the exigencies of international strength requirements allow. Thus, the new team will be held in check for at least two years while the "fat" is squeezed out of the present enormous procurement activity. The prediction, then, is for no further expansion of aircraft *production* but, it is hoped, for the creation of additional air *power* out of the present budget. Economic and efficient administration of the program can make really enormous strides towards slashing the virtually runaway price increases in aircraft and equipment during the past two years.

For with the businessmen of aviation now meeting face-to-face with equal (and often better) qualified and experienced businessmen across the negotiating tables of the Pentagon, it is inevitable that "more will be done more quickly at smaller cost."

John Floberg, another ex-Commander in the U.S. Navy, was Assistant Secretary of the Navy for Air under the Truman Administration and has been selected to remain in his post.

The new Administration will need the help of the Republican Senate majority, led by Robert A. Taft, in eliminating the tangle of red tape in the Defense Department by means of changes in the existing laws.

Helicopters over New York

Since October 15th, 1952, New York—following the example of Los Angeles and Chicago—has had its regular helicopter mail service. It was opened by *New York Airways Incorporated,* who started with a triangular route between La Guardia, Idlewild and Newark with two Sikorsky S-55 helicopters.

Today sixteen services are run daily between New York's three big airports, each helicopter carrying up to 1,500 lbs. of transit mail. Flying times are : La Guardia—Idlewild, 10 minutes ; Idlewild—Newark, 19 minutes ; Newark—La Guardia, 16 minutes. The whole triangular route is thus covered in 45 minutes. The mail truck takes four hours to make the same trip.

On delivery of a third S-55 (December 1952), NYA also started carrying mail to ten communities North of New York City, in the neighbouring State of Connecticut. This service is flown twice daily. Three more airmail routes—to the west, south and east of New York City—are to be opened shortly and extended step by step (see map).

Mail for the City of New York itself, however, still has to be loaded into trucks at the airports. The Port of New York Authority, which is responsible for the city's airports, and the United States postal authorities are therefore planning to build *"heliports" on the roofs* of the main Manhattan and Brooklyn Post Offices.

At the moment helicopters do not fly over the city centre, so that the population has had little experience of rotor noise. Noise abatement experts are feverishly at work to reduce helicopter noise—and everyone will wish them success ... otherwise helicopter traffic will have to be severely restricted over residential and business sections.

In the event of engine trouble, emergency alightings could be made on the city's extensive waterways. The S-55s' fuselages have therefore been made buoyant. Cockpits have also been equipped with R/T and up-to-date navigation aids. Yet a cloud base of 1,500 ft. and a visibility of two miles are still the minimum conditions for flying (why ... when normal air transport can operate under conditions a third as good ?

Helicopter Taxis

How soon helicopter passenger services, at any rate for transit passengers between one of the city's airports and another, can be organised, is difficult to say. A report issued by the Aviation Department of the Port of New York Authority[1] is very optimistic. It assumes that the first aerocab shuttle services can be inaugurated in 1953, for example for air travellers arriving at Idlewild and wishing to continue their journey from Newark. If its fares were reasonable a high-speed service of this kind would be well worthwhile, as the table on this page shows.[2]

There should be no lack of customers. In 1952 roughly 6,900,000 passengers took off and landed at New York's airports ; by 1975 this figure is expected to reach 14,800,000. About 55% of all New York passengers come from or go to Manhattan.

There are, however, two major difficulties confronting such an air taxi service :

— lack of suitable equipment ;

— shortage of heliports.

Admittedly today's *Sikorsky S-55s could be fitted with eight passenger seats,* but then they would not be particularly economic. And emergency alightings in the East River or the Hudson—engine failures are always possible—are doubtless not to everyone's taste. New York Airways are therefore not yet talking about passenger services. The company evidently plans first to get extensive experience of mail operations and await the provision of larger, fully-tried twin-engined helicopters (for example Sikorsky S-56 or Piasecki H-16). Still they may yet decide to experiment with passenger services in the S-55.

[1] *Transportation by Helicopter 1955-1975,* a study of its potential in the New Jersey—New York Metropolitan Area. Published by the Aviation Department, The Port of New York Authority, New York, 1952.

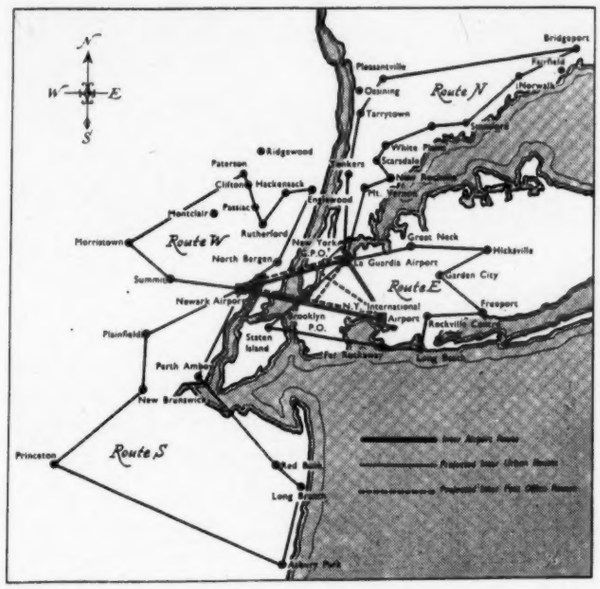
[2] Ibid, p. 38.

Comparative times and cost for bus, taxi and air taxi

From La Guardia Airport	To Idlewild		To Newark		To Manhattan-East	
	time (min.)	cost ($)	time (min.)	cost ($)	time (min.)	cost ($)
by bus	35	1.25	180	3.50	22	1.25
by taxi	23	3.40	60	12.00	20	2.15
by air taxi	10	4.00	17	6.00	8	2.25

(Helicopter charges are calculated for 30-to-40-seat helicopters, which will not be available until 1960.)

One of New York Airways' Sikorsky S-55 mail helicopters over the busy airport of La Guardia.



New York Airways' mail network: only services in operation so far are on the triangular La Guardia—Idlewild—Newark run (sixteen flights a day) and the northern mail circuit (twice a day).

The Hudson (foreground) and East River (rear) offer good sites for pier-top heliports near the city's centre.

As for the second difficulty—the shortage of landing areas in the city centre—there is at the moment only one, rather small heliport, built out into the East River at Pier 41. It is miles from the Manhattan business centre.

Heliports in downtown New York

All those who have studied the problem realize that heliports will have to be constructed as close as possible to midtown Manhattan before any air taxi or suburban services can be envisaged. However, all are far from agreeing on where and how.

For example, the *Port of New York Authority's* experts propose the construction of two *roof heliports on existing buildings in Manhattan,* supplemented by a pier in the East River (at the end of Wall Street) and another roof heliport in Brooklyn (on the post office ?). The two midtown terminals would measure 200 by 800 ft., but have up to 18 loading positions, with separate take-off and landing areas.[3] *Helicopters would therefore have to fold their rotors while loading.* By 1975 there are expected to be 282 helicopter movements (take-offs and landings) a day at midtown Manhattan's West Side and 495 at the East Side, and a peak of 30 movements an hour during rush hours.

The usefulness of such "monster buildings" is doubted not only by European experts.[4] In particular the necessity of folding the rotors would seem to complicate operations unnecessarily.

The New York City authorities were therefore well advised to make an extensive programme of *helicopter bases on harbour piers.* Edward F. Cavanagh, Commissioner of the Department of Marine and Aviation, New York City, recently announced details of the plan: a concrete landing deck will be built on Pier 57, now under construction in the North River; other shore-line installations round Manhattan are to follow, probably designed for joint seaplane and helicopter use. Cavanagh stressed that the City's waterways make natural helicopter flyways. And a number of smaller heliports will undoubtedly be more useful in the rush hours than one or two central helicopter stations.

Handling helicopters and their passengers at the major airports hardly presents a problem, and in the suburbs simple ground level landing areas will suffice.

Suburban services

Today 25 million people live within a radius of 150 miles of Manhattan, half of them in the heavily populated Metropolitan Area. By 1975, this population is expected to increase by 15%.

Manhattan is the natural centre for all these people. Thousands of businessmen and office workers stream into the island in the early morning, followed a little later by women on shopping expeditions. From five o'clock onwards the flood begins to move back into the suburbs, ending up with the last theatre-goers around midnight.

True, most New Yorkers live either in Brooklyn, the Bronx and Jersey City, or a little further out in Newark, Elizabeth or Queens County. They use the subway, buses or their own cars. However, the number of commuters—those people who in spite of working in the city still prefer living in the country, and would rather spend several hours a day going backwards and forwards than take a city apartment—is constantly growing. Commuters travel by bus or by suburban trains, and only rarely by car, because of the parking problem.

The volume of suburban rail traffic is shown in the table[5] on the following page.

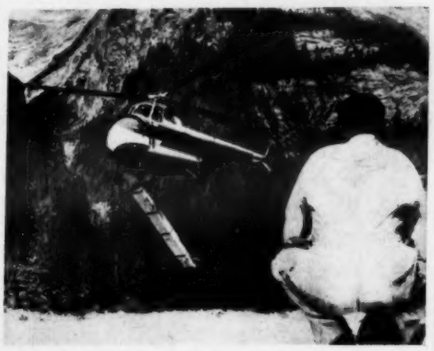
[3] Ibid, p. 71.

[4] Cf. *G. Kühne* "Helicopter Terminals," INTERAVIA, Review of World Aviation, No. 11/1952, p. 644–646.

[5] *Transportation by Helicopter*, p. 119.

A 15-seat civil version, the PD-22, is to be produced of the 21-seat Piasecki H-21 *Work Horse* military helicopter.

The versatile helicopter

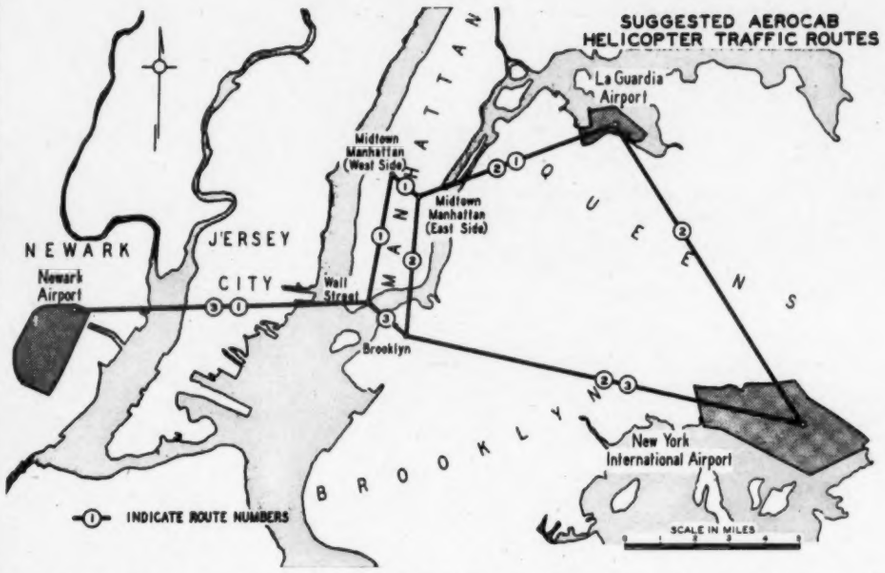


Carriage of supplies: Sikorsky S-55.

Mail services: Bell 47.

Fighting forest fires: Bell 47.

Sea rescue service: Bell 47.



Port of New York Authority's proposal for an air taxi service to the three major airports: two roof-top heliports in midtown Manhattan; a pier-top heliport near Wall Street; a roof heliport in Brooklyn.

Estimated daily suburban rail passengers to and from New York City

Time (from/to)	Load factor	Passengers per train	No. of trains	Total passengers
00.01—06.00	5 %	21	185	3,885
06.01—07.00	50 %	210	133	27,930
07.01—10.00	85 %	357	575	205,275
10.01—11.00	30 %	126	97	12,222
11.01—15.00	25 %	105	373	39,165
15.01—16.00	35 %	147	130	19,110
16.01—19.00	85 %	357	554	197,778
19.01—20.00	25 %	105	94	9,870
20.01—24.00	10 %	42	213	13,146
Total			2,454	528,381

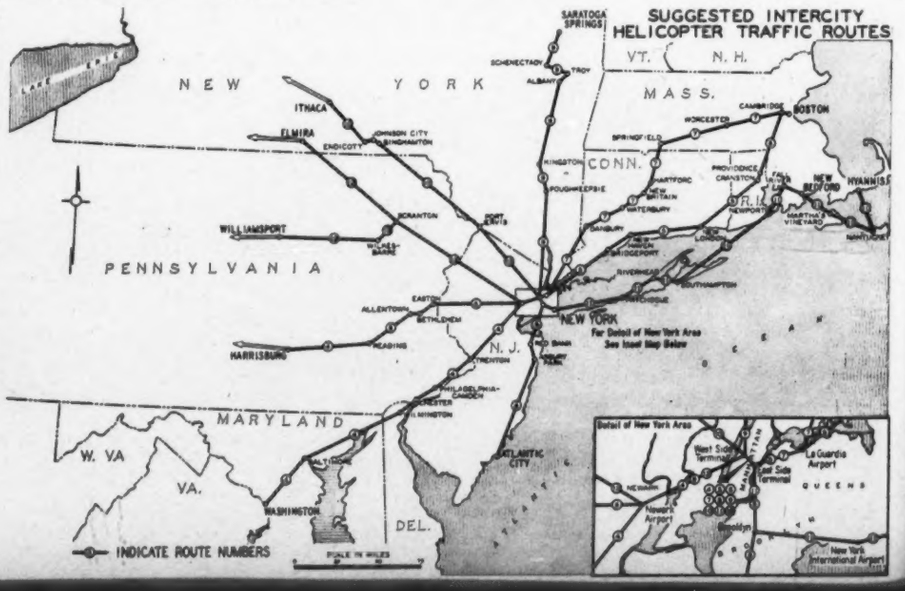
Remarks: Number of trains is taken from timetables for May 1st, 1952, and load factor is estimated. Average suburban train is assumed to have 420 seats (6 cars with 70 seats per car). About two-thirds of all passengers use reduced-fare commuter tickets.

Provided it can offer adequate safety (twin-engined model) and is big enough, the helicopter could draw off a considerable share of this constantly growing commuter traffic. Helicopter suburban services would be valuable to the businessman of Manhattan, the industrialist in the neighbourhood of New York who has to go into town for important meetings, even occasionally to the office worker who has missed his train. Last but not least, a good many long-distance air travellers would use the helicopter to get from their homes to the airport.

What about fares? The helicopter will always be dearer than surface transport services, because of its high purchase price and operating costs. At the moment, too, it is at a disadvantage compared with normal airliners, which can fly two or three times as fast for the same expenditure. For example scheduled airlines in the United States reckon on maintenance costs of only $0.004 per seat-mile offered, whereas expenditure on airframe, rotor, transmission and power plant maintenance for today's helicopters is still $0.018 to $0.026 per seat-mile. Nevertheless it is to be assumed that helicopter design will be greatly simplified (which will reduce maintenance costs) and that operating costs will also fall when seating capacity and cruising speed are increased. The Port of New York Authority's report foresees the following development trend[6]:

[6] Ibid, extracts from p. 12, tables 4 and 10.

Port of New York Authority's proposal for an intercity helicopter network to cover the whole densely-populated East Coast area from Washington to Boston.



Probable developments of commercial helicopter from 1955 to 1970

Period	Seats (passengers)	Payload for 50 miles (lbs.)	Cruise Speed (m.p.h.)	Cost Price ($)	Direct Costs ($ per seat-Mile)
1955-1960	8-10	1,400-2,000	85-100	145,000	0.086
1958-1965	15-21	3,500-3,700	115-120	231,500	0.063 *
1963-1970	30-40	10,000-12,000	135-145	708,500	0.056

* Direct costs for the 15-seat civil version (PD-22) of the Piasecki H-21 break down into : petrol and oil 18.4%, air-frame depreciation 25.6%, engine depreciation 4%, airframe maintenance 24%, engine maintenance 4%, pilots 9.6%, insurance 14.4%.

A load factor of 65% and indirect costs amounting to roughly 40% of the direct costs (breakdown : ground services 36.7%, ground maintenance 16.5%, passenger service 7.9%, ticket offices 15.1%, publicity 4.2%, general administration 19.1%, depreciation of ground installations 0.5%) give the following picture :

Costs per passenger-mile

1955	$0.182/pass.-mile
1965	$0.126/pass.-mile

(In Europe costs would probably be twice as high.)

Even in America these costs, and the corresponding fares, are still much too high.

Rail coach travel costs no more than $0.035 per mile, i.e. 19 to 26% of the above prices, even without the various reductions granted on commuter tickets. If helicopter suburban services are to be competitive, *much larger helicopters, for 60 to 90 passengers, will be needed.*

Piasecki is already said to be equipping its twin-engined XH-16 model (first flight this year ?) for 52 passengers and to be preparing a larger double-decker version for 85 passengers. Sikorsky and Bell are to build large turbine-powered helicopters with transmission drive, while Hughes is working on a double-decker civil version of its jet-powered XH-17 "flying crane."

Prospects for intercity traffic

Before actual suburban services are available it is likely that intercity services will be opened. The optimists expect that a beginning will be made in 1960.

Intercity services will link all the larger towns within about 175 miles radius of New York with the city and its airports ; block distances will be about 45 miles (compared with 20 miles on suburban services). In the Port Authority's plan, services will extend northeast to *Boston* and southwest to *Washington,* although direct services between these two cities and New York will continue to be operated by fixed-wing aircraft.

On the Manhattan-New London service (about 120 miles northeast of Manhattan) time saved by the helicopter over the train would be 68 minutes—65 minutes compared with 133 minutes. How far the helicopter, however, can compete in cost with the rail coach fares ($4.82) or the parlor car fare ($7.65) is a question of operating costs and seating capacity and has already been discussed above.

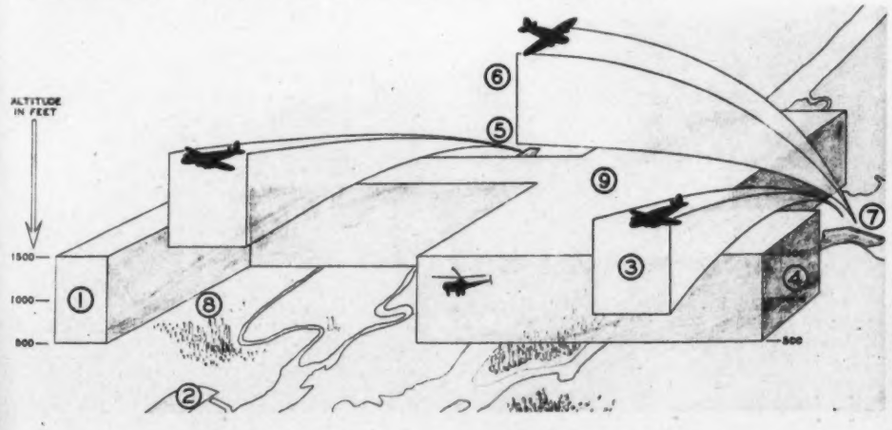
Safety is expected to be greater than for fixed-wing aircraft. By about 1970 there will doubtless be *high intensity* of services and absolute *regularity* of schedules, thanks to adequate air fleets, additional navigation aids and improved traffic control. Travelling by helicopter will be as comfortable as by rail.

The Port Authority already has prepared plans for separating helicopter routes from the normal commercial airlines' airways (see sketch). The erection of three more omni-ranges in the city centre (low-power VORs) will enable helicopters to keep strictly to their own routes, and they will certainly not be permitted to fly over the city just as they please.

*

There is no doubt that commercial helicopters of the future will greatly increase air transport over short stages.

Separation of airways for helicopters and conventional airliners in the New York area : 1. Helicopter airways (500 to 1,200 ft. altitude ; minimum height for other aircraft 1,500 ft.) ; 2. Newark Airport ; 3. Airway for New York/La Guardia—Washington airliners ; 4. Helicopter airway to Idlewild ; 5. Teterboro freight airport, with approach and departure airways ; 6. Airway for fixed-wing aircraft from New York/La Guardia to the West and Northwest ; 7. La Guardia Airport ; 8. City of Newark ; 9. Helicopter zone over New York City.



The versatile helicopter

Pest control : Hiller 360.

Droving : Bell 47.

Military supplies : Piasecki HRP-1.

Transport of wounded : Sikorsky S-51.

Miniature Jets for Peace and War

A factory in the Basque mountain town of Bordes, Basses Pyrenées, France, is turning out small gas turbine engines which are not only powering the first jet-propelled sports aircraft and light trainers but may also equip some of the "fantastic new weapons" announced by former U.S. President Harry S. Truman in San Francisco at the beginning of September 1951. It is no secret that concrete interest is being shown in the new engines not only by the French Government and aircraft manufacturers, but also by the U.S. Navy, American and British engine and aircraft makers.

The factory at Bordes, 25 miles north of the Spanish border, belongs to *Société Turboméca* which so far has developed six basic types of small gas turbine engine—four jets and two shaft turbines. Of these, four are adaptable to guided missiles, four can power light aircraft, and four are suitable to boost the take-off power of conventional transports. All six can be used in remote-controlled target aircraft to train pilots and anti-aircraft crews.

The President of the company, who is also the designer of the engines, is 56-year-old Joseph Szydlowski, a naturalized Frenchman born in Poland. It is mainly his driving energy which built up the company to its present size, without Marshall Plan aid of any kind.

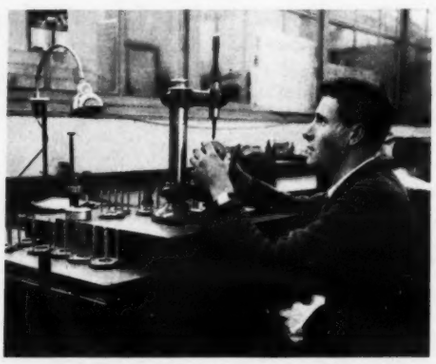
The Turboméca factory is run largely as a development plant. Szydlowski and his 600 workers rarely lay down a production line after building and testing a new engine. Instead, the president of the company sells the manufacturing licences, saying that this procedure is more in keeping with the French workers' liking for individualistic jobs in preference to over-standardized work.

Société Turboméca is headed by Joseph Szydlowski.

Another argument Szydlowski advances against mass production in France is the size of the demand in his country. Demand is not strong or stable enough to warrant setting up an expensive production line, he explains.

So far, this policy has paid off. In America, Continental Motors Corp. of Detroit has bought the manufacturing rights to five of the basic designs, the Stratos Division of Fairchild Engine & Airplane Corp. the rights to one. In England, Blackburn & General Aircraft

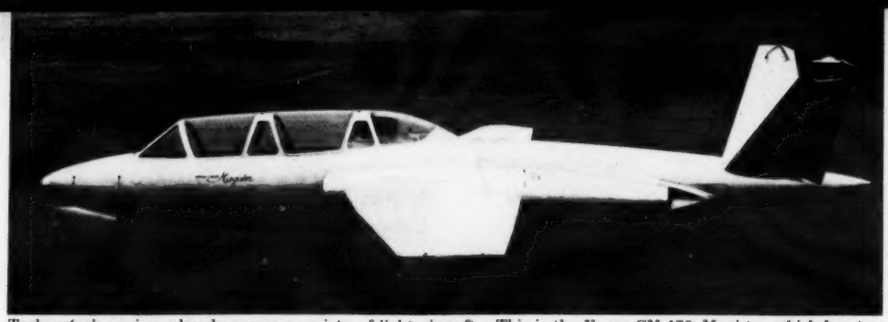
Draughtsman Jean Gommez is one of Turboméca's 600 employees. He designs electrical equipment for the company's small jet engines.



Inspection : Edouard Hudord carefully weighs jet engine parts.

The engine assembly room. Turboméca does not engage in mass production, prefers to sell its manufacturing licences.

Bernard Perise and Louis Nouget, Turboméca employees, prepare a jet engine for testing in the testing chamber. Research equipment at the factory includes one of the highest-speed wind tunnels in France.



Turboméca's engines already power a variety of light aircraft. This is the Fouga CM-170 *Magister*, which has two *Marboré II* jets of 880 lbs. s.t. each.

Turboméca's products

Engine type	*Output (Take-off rating)*	*Licencees*
Piméné (jet)	240 lbs. (110 kg)	Continental Motors Corp. (USA) Blackburn & General Aircraft (GB)
Palas (jet)	330 lbs. (150 kg)	Continental Blackburn
Marboré I (jet)	660 lbs. (300 kg)	Continental Blackburn
Marboré II (jet)	880 lbs. (400 kg)	Continental Blackburn
Aspin I (ducted fan jet)	485 lbs. (220 kg)	Continental Blackburn
Aspin II (ducted fan jet)	795 lbs. (360 kg)	Continental Blackburn
Artouste I (shaft turbine)	280 CV	Continental Blackburn
Artouste II (shaft turbine)	400 CV	Continental Blackburn
Orédon (shaft turbine)	160 CV	Stratos Division of Fairchild (USA) Blackburn

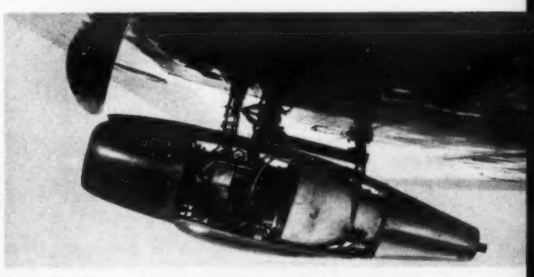
The Fouga C.M.8.R-8.3 *Midjet* light racer. It has a Turboméca *Palas* jet of 330 lbs. s.t.

One of the smallest aircraft to be fitted with a Turboméca light jet is the SIPA 200 two-seater, which is powered with a *Palas* of 330 lbs. s.t.

The Morane-Saulnier MS.755, powered with two *Marboré II* jets, is the latest aircraft to receive Turboméca engines.

Ltd. has acquired licences and sales rights for all six types. The U.S. Navy is reported to have placed orders with Continental Motors, but no details have been disclosed. A Brazilian airline, VARIG, has had two of Turboméca's *Palas* jets fitted under the wings of one of its Curtiss C-46 *Commando* twin-engined transports by an Italian company, Officine Aeronavali, of Venice, and tests have shown that substantial increases in take-off weight are possible. Detail designs of the installation had been perfected by SNCA du Sud-Ouest, and the Brazilian carrier has since equipped its entire fleet of eight aircraft in this manner.

Szydlowski is known as the man largely responsible for the design which enabled some of the French to drive their cars during World War II, in spite of the total lack of gasoline. By using the small compressor he had designed, cars were able to run on wood gases. He was building these compressors until the Germans occupied Bordes late in 1942, and he had to flee to Switzerland because of his Polish background. A German scientific team working in France moved into his factory and began



Two *Palas* small jets have been fitted to a Curtiss C-46 *Commando* transport of the Brazilian VARIG airline to permit higher take-off weight.

design work on a large jet reaction motor which was supposed to be fitted to a rocket capable of bombing New York. The story goes that Hitler thought the project too expensive and ordered it to be dropped. However, when his forces retreated, they took most of the plant's machine tools with them to Germany.

Today, Szydlowski's engineers are not concentrating their energies on the development of power plants for warlike purposes alone. They are also hoping for a revolution in the field of small civil aircraft : in fact, they are envisaging their light gas turbines of small frontal area as the power plants of private aircraft with top speeds of 400 m.p.h.—a jump of about 100 percent over present private aircraft performances.

Press Mosaic

*** "United Press" (London), 26th January, 1953: British Government not to finance interplanetary travel**

"Asked by W. R. D. Perkins to appoint a select committee of scientists to advise the Government so that Britain did not lag behind in interplanetary travel, Mr. Duncan Sandys, Minister of Supply, said he did not think it would be useful. 'Even in this age of the Welfare State, interplanetary travel is a service for which the Government do not yet accept responsibility.' "

*** "Armed Forces News" (issued by Canadian Directorate of Public Relations), 23rd February, 1953: New Bridge Rules for RCAF**

"RCAF air crews flying the Korean airlift have come up with a new type of bridge game that could make them dear to the hearts of thousands of conscientious card players. Actually, the game hasn't changed but the men have come up with an entirely new method of bidding—not a word is spoken . . . Handicapped by oxygen masks and the terrific noise of the four engines, the players (the spare crew) soon found it was impossible to talk . . . To bid three clubs all you do is to raise three fingers and then clench your fist . . . To bid hearts the player points to his heart . . . To bid diamonds the player points to the ring on his finger and spades is a shovelling motion over the shoulder with an arm. To pass the player merely bends his elbows with his forearm horizontal across the chest. All players agreed they had not had an argument about talking across the table . . . since they started playing nearly a year ago."

*** "Die Tat (Zurich), 14th February, 1953: "Cattle subsidies yes—jet research no!"**

"Back in 1937/38 our forces had no air fleet worth mentioning. We still have no aircraft which can compare with the best of our neighbours! Today our neighbour is anyone who can reach us in an hour's flight. Aircraft which other countries let us have at high prices are already out-of-date when we get them. At best we are offered machines from the last development stage but two, and even these can never be delivered within a year—or more."

*** "Newsweek," 12th January, 1953—The Periscope: "Who's the villain?"**

"Thousands of anti-Red handbills were recently dropped over big areas of western Hungary. They called for continued sabotage and faith in eventual liberation. The Red régime is investigating, particularly among passengers and personnel of the Soviet-Hungarian Maszovlet Aviation Society, a passenger airline. Most of the handbills were found in the area crossed by the company's air routes."

*** "Der Spiegel," 11th February, 1953—"Hohlspiegel"**

"Correspondent Flick-Steger was commissioned by his news agency to track down the headquarters of the 'Anti-War League' in Bonn. His enquiries were fruitless. As a last resort he asked telephone enquiries. Reply: 'The Anti-War League?—Just a moment—3 18 71' . . . This is the Blank Office telephone number." (The Blank Office is the precursor of a future West German Defence Ministry.)

*** "Die Zeit" (Hamburg), 12th February, 1953: "New Japan at work," by Fernand Gigon (Switzerland)**

"When one lands at Tokyo's airport, the police appear to be quite helpless. They run right and left, fetch the Customs officials, send them away again, shut passengers into a room, open it up again, until their chief arrives. The latter greets the new arrivals with a long speech and then gives instructions for passport and Customs check. Before his arrival all is confusion, afterwards order and method. But in between a whole hour may go by, for if the chief is not there, nobody can take the initiative."

*** "Time," 9th February, 1953: "Texas air war"**

"Dallas and Fort Worth are only 30 miles apart—almost as close, one might say, as two tomcats in a shoe box—and this proximity has bred in citizens of both cities a splendid sense of mutual distrust. Nevertheless, back in 1941 when it became evident that the airports of both towns were getting outmoded, they joined forces to plan a huge, jointly owned field midway between the two cities. Then Dallas representatives made a horrible discovery: the field entrance was to be a mile and a half closer to Fort Worth than to Dallas. They walked out, and the plan fell through.

"Fate intervened. During the war, the Navy graded the site, and built runways . . . Forth Worth took the site over, began converting it at tremendous expense into the Greater Fort Worth International Airport . . .

" . . . Though there was no real reason why Dallas air passengers could not use the new, safer Fort Worth facilities, few permitted themselves even a second of such treasonable thought. Dallas, its citizenry decided, must have a big airport too. The solution seemed simple: all they had to do was rip down houses in which hundreds of families live at present, subject other residential areas to the constant snarling of aircraft, and spend about $15 million . . . Last week Dallas citizens voted approval of a $12.5 million bond issue to get up the bulk of the issue.

"Could Fort Worth permit such a development without retaliating? . . . It seemed only a question of time before both cities were bowling over houses and converting their sites to runways. The folks could camp out in tents around the edges or just fly up to New York and settle down with all the other Texans in the Waldorf-Astoria."

*** "Die Zeit" (Hamburg), 28th February, 1953: "German hotels in return for aircraft"**

"It was not by chance that the President of the largest American overseas air transport undertaking, Juan T. Trippe of Pan American World Airways, was decorated in Bonn. After all, it was he who, with consummate skill and despite the many and varied rumours about a projected agreement with KLM or TWA, solved the Aktiengesellschaft für Luftverkehrsbedarf's flying equipment problem, at any rate for the initial period of German air transport operations, to the satisfaction of both parties.

" . . . The Aktiengesellschaft für Luftverkehrsbedarf is to buy three (later more) representative hotels in Frankfurt, Wiesbaden and Hamburg (including the Carlton Hotel, near Frankfurt's main railway station, which has been requisitioned for years) for D-Marks and hand over these buildings to PAA in return for Convair 240 twin-engined medium-range aircraft from the company's Caribbean fleet and perhaps for Douglas DC-6 long-range transports . . .

"It is indeed regrettable that these gratifying plans (for Herr Schäffer) cannot conceal the internal dissension within the AG für Luftverkehrsbedarf . . . There is talk of Dr. Knipfer, Deputy Chairman of the Board, and head of the Aviation Section of the Federal Transport Ministry, resigning, but this is denied in Bonn. Rightly or wrongly . . . both the economic and the technical planning sections of the company and the Länder appear to be complaining that the Government's strong majority policy represented by Dr. Knipfer, which is showing increasing intolerance of other opinions, is the cause of the unusual reserve shown by the West German private capital market . . . It is being said that Dr. Knipfer has advised Dr. Seebohm badly, and that this will have its consequences."

What's in the Air ? *

Aviation politics

● *American arms aid for Europe . . .*

The Mutual Security Agency has announced in Washington that *Great Britain* is to get $133,115,000 in 1953, which brings the total U.K. allotment up to $400,000,000. 1953 allotments for the other *Atlantic Powers* (in descending order) : France $ 200,000,000, Yugoslavia $ 80,000,000, Italy $ 40,000,000, Austria $ 35,000,000, Germany $ 23,787,000, Turkey $ 20,000,000, Denmark $ 4,500,000, Iceland $ 600,000.

● *. . . Jet fighters for Chiang Kai-Shek*

Usually well-informed circles in Washington claimed on February 13th that deliveries of Republic F-84 *Thunderjet* fighter bombers and reconnaisance versions of the Lockheed F-80 *Shooting Star* to Marshal Chiang Kai-Shek's nationalist Air Force on Formosa will begin " fairly soon ". It is believed that as much as $ 500,000,000 may have been earmarked for military aid of all kinds to Formosa in the 1952 and 1953 fiscal years.

● *R.A.F. versus U.S.A.F. controversy*

The " Evening News " of February 19th (Lord Rothermere's London newspaper with the world's largest evening circulation) reported an alleged move by the United States to take over command of all Anglo-American bomber strategy : " M.P's are to seek information . . . clarifying official policy on the future of the R.A.F. Bomber Command . . . Strong efforts have been made by the U.S. Air Force chiefs in Washington to have it conveyed to the British Government that all bomber strategy of the future in all areas should be left entirely to the Americans." The newspaper adds, however, that " these views have been passed on in the friendliest manner, the Americans pointing out that it would be in the interest of the operational efficiency of the two Air Forces as well as saving a considerable expenditure for Britain." — Nevertheless, *R.A.F. chiefs have protested* against such a policy to " wind up Bomber Command ". The R.A.F.'s views are said to have been conveyed to Prime Minister Churchill by Marshal of the Royal Air Force Sir John Slessor (who retired at the end of 1952 from the position of Chief of the Air Staff).

● *U.S.A.F. bases in Afghanistan ?*

According to Radio Moscow the United States ambassador to Kabul and the Afghanistan Minister of Foreign Affairs have signed an *agreement providing for the construction of American air bases in Afghanistan* (particularly in the Northern territories). Radio Moscow stated that " the agreement was camouflaged as a commercial treaty between the two countries."

● *American-Russian Air Battle over Japan*

On February 16th two American F-84 *Thunderjets* sighted two Lavochkin LA-11 propeller fighters over the most northerly Japanese island of Hokkaido and called upon them to land. When the fighters did not comply the Americans opened fire, damaging one of them, whereupon the intruders made off towards the Russian-occupied Kurile Islands. To avoid violating Russian air space, the Americans did not pursue them.

Pierre Desautels, hitherto Trans-World-Airlines' Regional Sales Manager in San Francisco, has been appointed Director of T.W.A.'s International Sector with headquarters in Paris.

Senior Pilot Adrian Viruly one of K.L.M.'s oldest air crew members, who has flown more than 17,000 hours since April 1927 and covered a distance of over 3,100,000 miles, has been named Commodore.

● *British statement on defence 1953*

The British government's White Paper on *defence in 1953* is based on the following principles : without changing the objectives of the U.K's defence efforts, it is considered especially important to get fullest possible value for money expended and to avoid the production of defence equipment which will have to be replaced at " heavy costs within a relatively short space of time "; and the need for greater defensive strength must be balanced against the risk of overstraining the national economy, resulting in economic collapse even in the " cold-war period ". *Defense estimates 1953/54 :* £1,636,760,000 (£1,513,500,000 the previous year)—the highest defence estimates since the end of the war : Army £581,000,000 ; Navy £364,500,000 ; R.A.F. £548,000,000. Over 50% of the total production credits of £650,000,000 are for the British *aircraft industry*.

● *French Supreme Air Council*

The following Air Force generals have been appointed to the French Supreme Air Council : Generals Lechères, Chief of the Air Staff, Vice President, and Vallin, Inspector General of the Air Force ; Lieutenant-Generals Piollet and Fay and Major-Generals Bonafé and Bodet.

Service Aviation

● *U.S. Air Force personnel overseas*

No fewer than 24% of the U.S. Air Force's total personnel are at present stationed outside America, according to Lieutenant General Laurence S. Kuter. This percentage is expected to " increase greatly " during the next eighteen months.

● *U.S. Air Force in French Morocco*

The first long-range bombers of the U.S. Air Force's Strategic Air Command arrived at Sidi Slimane base in French Morocco in mid-February. Present plans call for one wing of Boeing *Superfortresses* to be stationed at the base at a time under a rotation policy. A strategic bomber wing numbers up to 65 aircraft, including 20 tankers for in-flight refuelling. — *General Curtis E. LeMay, Commanding General of the U.S. Air Force's Strategic Air Command*, and Colonel Schilling, head of the U.S.A.F's In-Flight Refuelling Section, made a *tour of inspection of U.S.A.F. bases in North Africa and Western Europe* during February.

● *March Air Force Base Expansion Programme*

The sum of $11,000,000 has been made available for the expansion of March Air Force Base east of Los Angeles near the Mojave Desert, which has been recognized as a *major continental jet bomber base*.

● *U.S. Air Force Training Tempo*

The following figures give a graphic illustration of the U.S. Air Force's efforts at reaching full combat strength as soon as possible : the 91st Air Refuelling Squadron, Lockbourne Air Force Base, Ohio, recently delivered its two millionth gallon of fuel transferred in mid-air. —A Lockheed T-33 two-seater jet trainer attached to the 433rd Interceptor-Fighter Squadron at Traux Field, Wisconsin, has flown 241 hours and 35 minutes in a single month, or an average of more than eight hours a day. — Four Lockheed F-94B two-seater all-weather fighters attached to the 58th Fighter-Interceptor Squadron at Otis Air Force Base, Mass., have completed more than 1,000 hours of airframe time in less than a year of squadron service.

● *Canadian Fighter Squadron in Germany*

A Royal Canadian Air Force fighter squadron is shortly to be moved to Germany and to be stationed at Zweibrücken (Rhine Palatinate). The Canadian Ambassador to Bonn has told the Federal Chancellor that the Canadian Government will pay all upkeep costs for the R.C.A.F. unit, as it already does for a Canadian infantry brigade which has been stationed in Germany since 1951.

● *Future German Air Force to have Eighteen Wings*

The New York Times Bonn correspondent reported early in March that the German authorities had decided on the organization of the " tactical air force " which is to be created after ratification of the German Treaty and to comprise 1,326 aircraft and about 80,000 men. There are to be :

Pieter J. C. Vos Managing Director of the Royal Dutch Aircraft Factories Fokker died suddenly on February 24th, 1953 at the age of 49. Vos, who was known at home and abroad as one of the most able and popular directors of the Fokker company, was a great supporter of European co-operation in the field of aircraft production. He played a leading part in founding the International Association of Aircraft Constructors, of which he was President from 1950 to 1952.

* Extracts from " Interavia Air Letter ", daily international news digest, in English, French and German. All rights reserved.

1) 10 wings of jet-powered ground attack aircraft or fighter bombers (73 aircraft each) ; 2) 4 wings of jet fighters (75 aircraft each) and two wings of all-weather jet fighters (36 aircraft each) ; 3) 2 reconnaissance units (54 aircraft each, probably jet-powered) ; 4) 2 transport units (48 aircraft).

Pilots are to be trained in the countries where the air force's equipment is made.

Air Transportation

● *I.C.A.O. Air Navigation Conference*

An Air Navigation Conference attended by representatives from 13 nations and 4 international organizations and at which problems of air traffic control, meteorology, air navigation and blind landing aids, in-flight and landing communication systems, was opened at the International Civil Aviation Organization's, Montreal headquarters on February 24th. It is the first I.C.A.O. Technical Conference to cover a group of associated subjects in the field of air navigation.—The frequent " stacking " of aircraft approaching a busy aerodrome in instrument flying weather is a common complaint of airline pilots, and I.C.A.O. hopes to devise " standard holding patterns " for the different types of instrument landing aid for use throughout the world.

● *PAA Proposes Cargo Freight Cut*

Pan American World Airways' Vice President for Traffic and Sales Willis G. Lipscomb announced towards the end of February that PAA had decided to " establish its own trans-Atlantic cargo rates reducing the cost of bulk shipments by 45% "—even if other trans-Atlantic operators fail to reach an agreement on PAA's proposal to this effect submitted to the International Air Transport Association. Beginning next November 15th rates will be $0.60 per lb. from New York to London for a shipment of over 1,102 lbs. (500 kg.), instead of the present $1.10 per lb. Lipscomb ended that his company's decision to go ahead with its own cargo rates independently was the result of the failure of other trans-Atlantic members of I.A.T.A. to agree on a satisfactory bulk rate at a Specific Commodity Rates Board Meeting held the previous week in New York.

● *Air France in 1952 and 1953*

First figures for Air France's activities in 1952 were given in mid-February by the Company's *President Max Hymans* at a reception in the Hotel Georges V, Paris. The salient point is that 1952 was the first year in which the company recorded *more than 1,000,000 passengers*, namely, 1,074,707 compared with 982,553 the previous year. — The outstanding event in 1953 will be the placing in service of *more modern aircraft. Super Constellations* will gradually be introduced on services to North, South and Central America and to Japan (during the summer season they will be used for mixed luxury/standard services and during the 1953/54 winter season they will also be put on the tourist services). *Comets* will probably operate medium-range services beginning with routes to the Middle East. *Viscounts* are destined for the European network and Breguet *Deux Ponts* will go to the Mediterranean services.

● *Germany, Air Charter Centre*

The German market appears to be occupying an *increasingly large place in the plans of all major air charter companies.* In spite of the introduction of tourist class services by the scheduled airlines, the charter companies believe that there will be constantly increasing demand for air services between German business centres and a large number of European cities, which cannot be fully met even when the regular air lines have expanded their fleet. The first to react to this situation seem to be the British charter companies, who would like to station a considerable number of aircraft at German airports to avoid having to fly out to Germany empty. The airports primarily under consideration are Frankfurt and Hamburg, and the aircraft the Avro *York*, the DC-3 and the Vickers *Viking*.

SO 9000 *Trident* supersonic interceptor fighter.

● *Refugee Air Lift*

The Federal Ministry for Refugees has increased the quota of East German refugees that may be flown out of Berlin to Western Germany by 30%, to a total of 950 per day. The cost of air travel will be borne by the West German Federal Republic, whereas the task of preparing the passengers for flight and reserving the requisite number of seats falls to Berlin.

● *Tokyo's Intercontinental Airport*

Tokyo Municipal authorities plan to construct a big new international airport on Tokyo Bay, *to cover about twice the area of the present airport at Haneda* and to cost about $40,000,000. It will have three 10,800-ft. runways capable of handling PAA's *Stratocruisers* or B.O.A.C.'s *Comets*, which find Haneda's 7,500-ft. runways a little " cramped ".

Industrial and Technical

● *West Coast Industry to engage 35,000 more*

Douglas, Northrop and *North American* plan to add 35,000 workers to their Los Angeles area payrolls during the next two years. This disclosure was made in a report to the Southwestern Traffic and Highway Association. The figure might be doubled if new hirings by Lockheed and by the many sub-contracting firms are included.

● The SO-9000 *Trident* supersonic interceptor fighter started flight testing at the beginning of March. It is fitted with two Turboméca *Marboré* jet engines in the wing-tips and a rocket engine in the rear of the fuselage.

● A fresh series of tests to try out new remote control systems and sighting equipment is being made in the *Arsenal ARS 5501* pilotless pulse-jet target aircraft. The aircraft is in production for the French Navy and has also aroused considerable interest outside France. Great Britain has bought six, and the Royal Dutch Navy is making tests with borrowed equipment.

● *The Convair XB-58* eight-jet bomber for transonic speeds is to have a delta wing. The engines, Pratt & Whitney J-57's of more than 10,000 lbs. static thrust, will be fitted two by two in the wings. The XB-58 is said to have a maximum speed of Mach 1.05 and a cruising speed of Mach 0.95.

● *The Allison Division* of General Motors Corp. has completed the conversion of a North American B-45C four-jet bomber into a flying test bed. It will be used primarily for testing the Allison J-71 turbojet.

● *The Convair XB5Y-1* flying boat with four propeller turbines is being converted for use as a tanker aircraft. It is being fitted with fuelling points at the wing-tips and in the rear of the fuselage to enable it to fuel three aircraft simultaneously.

● *Fairchild Engine & Airplane Corp.* reports the experimental installation in a C-119 of an auxiliary jet unit (Fairchild J-44), to be fitted in a retractable position on top of the fuselage.

● *Fokker* is developing new versions of the S.11 and S.12 two seater trainers with accommodation for three persons. The new models are fitted with a 240 h.p. Lycoming engine and retractable undercarriage. A development of the Fokker S.14 jet trainer with Rolls-Royce *Nene* turbojet (instead of the earlier Rolls-Royce *Derwent*) is also announced.

● A version of the well-known 240 h.p *Potez 6 D* engine with supercharger and direct fuel injection has been accepted for I.C.A.O. standards by Chalais-Meudon test centre. Permissible output 305 h.p.

● The American engine industry is said to have been offered a version of the *Rolls-Royce Conway* by-pass engine (to be copied ?). The version in question is said to have a specific consumption of 0.7 lbs./lb.t/h and a static thrust of 11,500 lbs.

Westward bound . . . The Polish Air Force MiG-15 jet fighter which landed on the Danish island of Bornholm early in March and which the Danish authorities have agreed to return to Poland. The pilot, a 21-year-old Polish Air Force lieutenant, has been granted political asylum.—Note the pilot's simple leather flying suit with ordinary earphones and flying goggles . . . compared with the American jet pilot's crash helmet and G-suit or the British pressure waistcoat.

Maintenance of Aircraft Electrical Equipment

By J. H. M. Sykes, Bedford

If it is true that an army still continues to march on its stomach, it is equally true that an airman now flies on his " electrics."

The extent to which the electrical equipment on a modern aircraft has grown when compared to the earliest commercial airliners is shown by the fact that the first London-Paris airline machines were only equipped with two 500 W generators for all purposes, whereas modern four-engine airliners need four 35 kW alternators ; and the power demand is still growing.

The maintenance of aircraft electrical equipment has become almost as large a part of airline organisation as that devoted to the aero engines themselves. A recent visit to the B.O.A.C. electrical and hydraulic maintenance workshops at London Airport showed how extensive is the organisation necessary to keep the ever-growing list of electrical items installed on modern airliners in efficient service.

Electrical equipment on aircraft may be divided into three general classes. The first concerns the radio and navigational aid equipment, with which we are not dealing in this article, since it is a highly specialised branch, and the equipment is not serviced by the electrical engineering staff. Secondly, there is the electrical equipment associated with the operation of the aircraft controls ; and finally the auxiliary electrical devices concerned with the operation of the aircraft and with the comfort and convenience of the passengers.

Before mentioning some details of the gear utilised in these two latter categories, the power generating plant must first be touched on.

There is an increasing tendency to utilise the advantages—in respect of reduced weight per unit output—given by a.c. power supplies, and an aircraft such as the jet engine *Comet* is equipped with four 85 kVA 24/26 volt 400 c/s alternators, each one driven from an accessory gearbox coupled to the compressor shaft. The B.O.A.C. fleet, however, in common with the majority of airlines, includes a number of machines which have been in service for some years and these are mostly equipped with the 28 volt d.c. generators, usually of about 10 kW each. The d.c. system formed the earlier standard aircraft power supply.

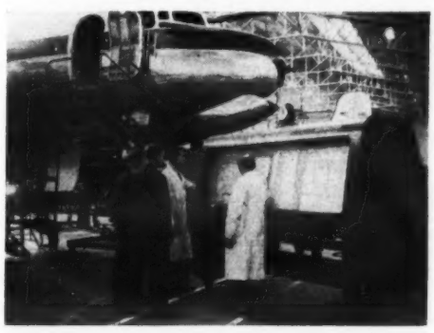
The alternators must naturally run at variable speeds, and to ensure constant-voltage power supplies for many auxiliary purposes, rectifying units are provided for each alternator, to give a 28 volt d.c. output. Some portion of the load, however, is fed directly from the alternator.

*

The electrical equipment concerned with the operation of the aircraft comprises first actuators for the control surfaces, and these may be either electrical or hydraulic or a combination of the two. Engine controls —for example for propeller pitch change operation—may also be hydraulic or electrical, and de-icing for wings and propellers is generally electrical. Heating elements within the propeller blades may need as much as 3 kW per blade. Electrical operation, by means of actuators for the landing gear is also sometimes used and a large number of fuel valves and alarm circuits for fuel and lubrication services are also electrically supplied. Fire alarm and control circuits also form another class of vital electrical equipment on a modern aircraft. There are also automatic pilot devices, which are electrically powered. In addition, there is the external aircraft lighting, both main and emergency.

The second class of electrical equipment comprises a number of items necessary for passenger comfort. These include pressurisation equipment, which may demand up to 1 h.p. per person ; and air conditioning gear with both heating and cooling elements —which may both be needed, in turn, during the course of a single long-distance flight. There are also cabin services of many kinds. These include cooking, refrigeration and a number of lighting applications, including fluorescent tubes.

In the Fleet Maintenance sheds. Portable illuminated schedule rack on the right gives guidance to maintenance workers.



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The number and diversity of the electrical items briefly listed above shows how complex must be the maintenance problem. The introduction of new types of aircraft, such as the Bristol 175 which is coming into service within the next two years, is another maintenance complication.

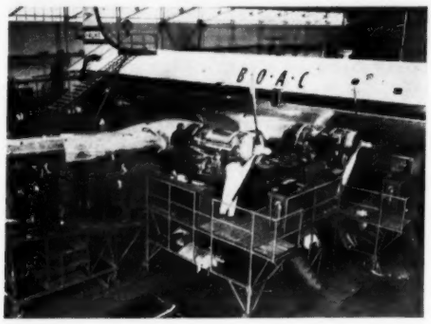
When the safety of the passengers and crew of an aircraft may well depend on the complete reliability of even the smallest item of electrical gear, it is obvious that much more rigorous maintenance methods must be adopted than would be the case for a similarly complex assemblage of electrical items in an ordinary static installation. It would not be difficult for an experienced engineer to evolve a system of maintenance which would be as near perfect as possible ; but it is a far greater achievement to do this and at the same time to observe the greatest possible economy.

Maintenance is carried out by the B.O.A.C. organisation in effect in five stages. The Fleet Maintenance Department is concerned with the routine day-to-day checking of every component of each aircraft as it is prepared for flight. This Fleet maintenance is carried out in four stages. The first comprises a general check of the aircraft at very short intervals, without dismantling any equipment other than that which the Master's report has indicated as being in need of special attention. The second and third stages comprise the checking on site of those items of equipment which the Air Registration Board in conjunction with B.O.A.C., has designated as being in need of inspection after a certain number of hours of service.

The fourth stage of the line maintenance involves major dismantling and the replacement by spare units of a considerable proportion of the electrical plant. It should be emphasised that all these inspections and replacements are carried out whether or not there has been any maloperation or failure.

The fifth stage comprises workshop treatment of plant which has either given rise to trouble in service or has completed the num-

Constellation *in Fleet Maintenance Department.*



Argonaut *in fourth stage of fleet maintenance schedule.*

ber of hours before major overhaul and inspection is necessary, under Air Registration Board rules.

The workshops in which this stage is carried out employ some 400 men, and, although extensive in character at the present time, are due to occupy greatly increased accommodation when the permanent buildings at London Airport are completed.

*

The first impression that the visitor gains is of the utmost attention to accurate documentation. Every single unit, of whatever kind, and every sub-assembly on that unit has a serial number : and on receipt of the component from the Fleet Maintenance Department, a history card is made out with a large number of carbon copies, so that the stores, costing and inspection departments may be made aware of exactly what work is being done. The unit is first stripped and cleaned with a special degreaser fluid, known as SPB 4, in a bay where the necessary fume extraction plant has been installed. The next stage is that of inspection. If the component is damaged, the exact nature of the damage is recorded, and if it is felt necessary to scrap it, the details are passed to a special salvage committee in which costing and technical experts are concerned so that any components which may safely and usefully be retained are not unnecessarily scrapped.

It may be of interest at this point to digress for a moment to consider how aircraft electrical equipment differs from conventional gear for similar purposes. Obviously, weight reduction is of the utmost importance. The generators, for example, are of designs in which very greatly increased outputs per pound weight are achieved when compared to normal practice. An alternator for a 30 kVA output weighs no more than 55 lbs. It operates at speeds up to 10,000 r.p.m. which are considerably greater than would be the case for industrial gear. This type of design naturally means that cooling equipment must be provided, and blown air at 200 cu. ft./min. (at sea level) is needed. Thus, failure of the blower would obviously involve rapid failure of the generator. The type of lubricating arrangement for the bearings must obviously be selected with due regard for the temperature at which these units operate. In passing, it may be noted that many papers on aircraft electrical equipment have stated that this roller bearing lubrication problem is one of the few which have not yet been entirely satisfactorily solved. The first alternator which the author saw passing through the maintenance line was one in which bearing failure had occurred.

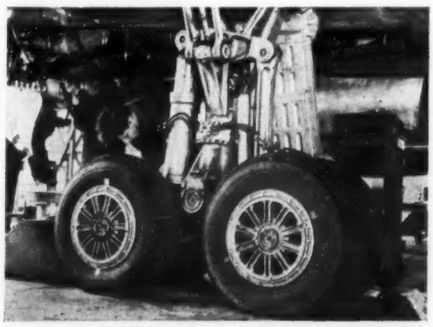
The point of this digression is to indicate that the majority of plant items are working much nearer their safety limits than would be the case with conventional land equipment for similar purposes. And consequently, maintenance operations and testing have to be carried out with this aspect of normal operation in mind.

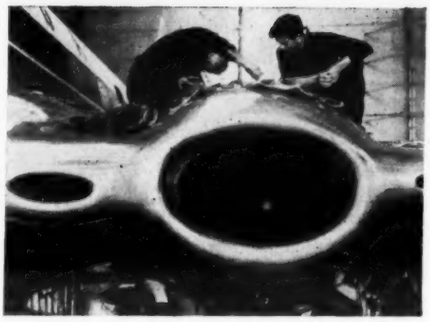
To return to the path of the equipment through the workshops, after cleaning and inspection it passes to the repair benches where the necessary new parts are issued. On re-assembly, three separate checks are taken : the fitter himself signs the history card, and the foreman countersigns. The inspector then makes a complete final check and appends his signature.

The equipment is then handed over to the Testing Department. Here, the Research and Development Branch of B.O.A.C. has provided a large number of special testing rigs for each type of component. Typical of these is a test rig for the engine synchroniser. Four motors, simulating the operation of the four propellers, provide the mechanical drive for the four tachometers which are part of the synchroniser. The speed of these motors is capable of a wide range of variation. The output from the tachometers is taken to the instrument itself, which comprises co-ordinated relay circuits feeding special step-by-step motors which operate (when installed on the aircraft) on the airscrew and so keep the four airscrews automatically in synchronisation. The complicated nature of the synchroniser unit obviously calls for the most thorough tests possible, and only by the provision of a comprehensive test rig of this nature with all the necessary instrumentation and recording devices (including an oscillograph) could the proving of the gear be successfully carried out.

Another example was seen in the generator test bay. Here, the comparison between the 10 kw generators—which are no more than about 18″ in length and 12″ in diameter—

Checking hydraulics on bogie chassis of Comet *in Fleet Maintenance Department.*

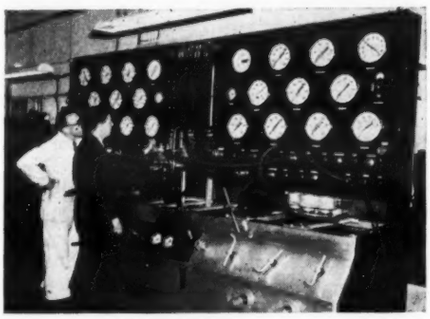




B.O.A.C. Comet *undergoing routine checks in Fleet Maintenance Department.*

and the size of the equivalent standard 3-phase a.c. motor needed to drive them at full and overload rating is most marked. The conventional motor is perhaps six or seven times greater in volume and weight. Full instrumentation both for the generator and its associated blower is provided on a convenient test panel.

Where alternators are concerned, a new test rig in which a console type control panel has been provided is under construction. Two 50 h.p. 1,400 r.p.m. Direct Current motors are provided, and the supply from the area board mains is taken through a



One of the hydraulic test rigs.

Part of the electrical components re-assembly bay.

Nevelin " Varionic " grid-controlled rectifier to enable infinitely variable speed control. The alternators are driven through gear boxes and the output shafts have a maximum speed of 14,000 r.p.m. Provision is also made for testing the associated rectifier and voltage control equipment at the same time as the alternator itself.

The equipment, once tested and passed in the workshops, is returned to the Fleet Maintenance Stores. The organisation is planned on the basis that the average period for a component to be out of service is no greater than four weeks.

The care taken with every type of electrical equipment does not cease once it has been handed back to the Fleet Maintenance Stores. An interchange of records between the two departments is so arranged that if a component has been held in store for a certain period without being called on, it is automatically sent back to the workshop for a check to ensure that the passage of time has not caused deterioration. Plating equipment is available for the addition of various rust-preventing finishes (such, for example, as cadmium coating), and if it is felt that a sufficient time has elapsed to render it desirable for replating to be carried out, this is done before the component is once again returned to store.

It is obvious that the degree of skill required for work of this character is of a high order, and so that a continual supply of trained technical fitters and testers will be available for the expanding scale of the Corporation's activities, a special Training School for aircraft electrical workers has been established near London Airport.

*

If the casual engineering visitor to the B.O.A.C. Workshops at London Airport felt on a superficial tour that the care taken in maintenance had been carried to greater lengths than is necessary in view of the reliability of modern electrical plant (and even if he were supported in this view by the very small percentage of items passing through in which any kind of failure had occurred) his criticism could at once be answered by a glance at the Corporation's aircraft operating records. The number of flights in which failure of the electrical gear had caused loss of life, is zero ; the number of delayed departures from the same cause forms only a fraction of one per cent of the total number of delayed departures ; and the number of Masters' reports at the end of an individual flight in which an electrical failure is recorded, is very small indeed. It would be a truly brave man who would dare to suggest that the electrical maintenance procedure could in any way be modified—or even improved.

The Convair *Sea Dart* *A Delta-Wing Fighter Seaplane*

The first prototype of the *Convair XF2Y-1 Sea Dart* twin-jet delta-wing fighter seaplane was " launched " at San Diego in mid-December 1952 and has since made its first flight.

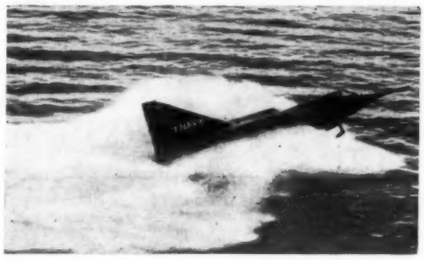
As our pictures show, the *Sea Dart* is a pure delta-wing machine, with a span of about 30 ft., a length of approx. 45 ft., and an estimated weight of 16,000 lbs. The angle of sweep of the wing leading edge is 60°, the conventional horizontal tailplane has been replaced by wing flaps, and the rudder unit is also triangular. Elevons (combined ailerons and elevators) are fitted to the trailing edge of the wing.

Another feature of the *Sea Dart* is its " hydro-skis ", a form of popular sporting equipment put to technical use. They are retractable and fitted beneath the hull, and lift the aircraft completely out of the water at relatively low speeds. The aircraft thus takes off and alights on its skis, floating on its own hull only when at rest. Convair maintains that take-off and alighting can be made without danger even in fairly rough seas.*

The XF2Y-1 is fitted with two Westinghouse J-34 turbojet engines of undisclosed model and probably reaches a maximum speed of 600 m.p.h.

Convair's development programme provides for the building of two prototypes of the *Sea Dart*, probably followed by a pre-production series of eleven. The pre-production and the ultimate production models will probably have Westinghouse J-40 jets.

* " Hydro-skis " were developed under a six-year joint programme by NACA, the U.S. Air Force, the U.S. Navy, All American Engineering Co. and Edo Corporation. During the experiments Edo Corporation fitted a Grumman *Goose* with water skis. In Great Britain Saunders-Roe is the firm most interested in the development of hydro-skis.



CORRECTION :

" Pionair " and " Viking "...

. . . have nothing in common. *Pionair Class* is the name given by British European Airways to the modernized Douglas DC-3s in service with the company, whilst the Vickers *Viking* has kept its own type name. The first caption (p. 148) to B.S. Shenstone's article in issue No. 3, 1953 (" Maintenance as Safety Factor ") should therefore read : *Douglas DC-3 (Pionair Class) and Airspeed Ambassador (Elizabethan Class).* The last caption (p. 149) should be : *Results of the overall check of a Vickers Viking are marked on progress sheets.* Our photo editor bows his greying head in shame.

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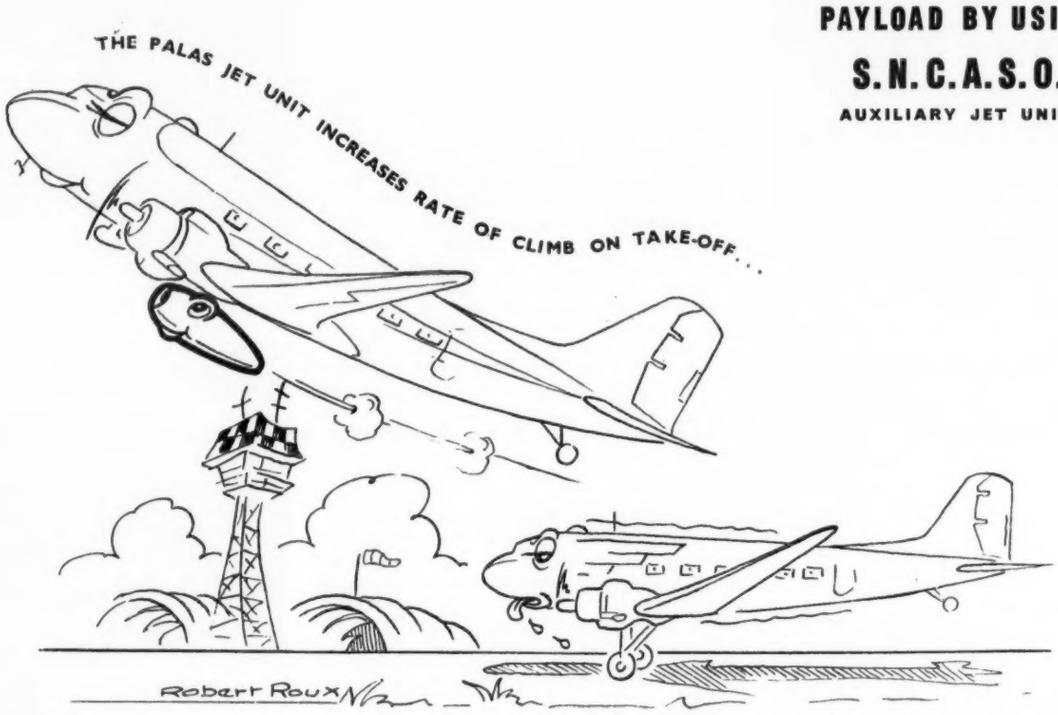

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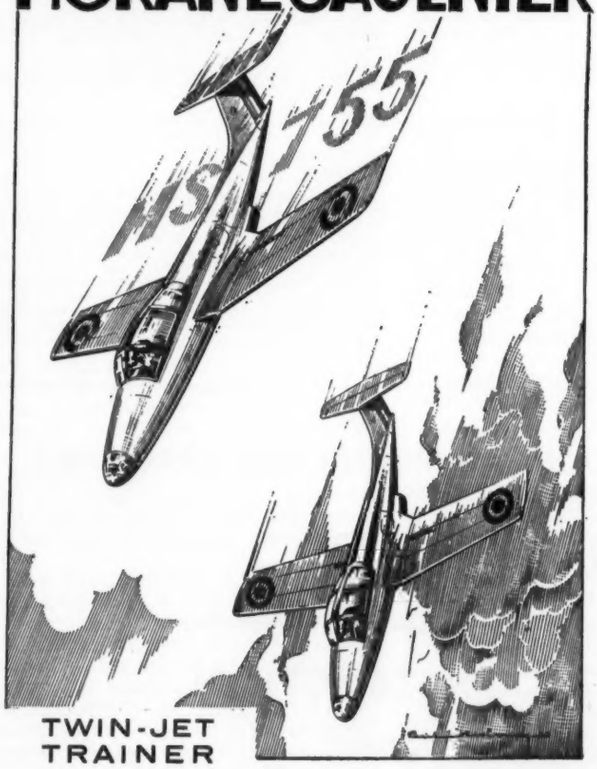

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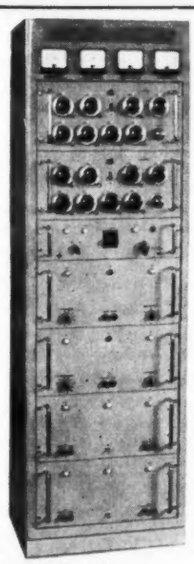

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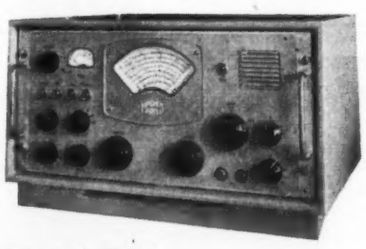

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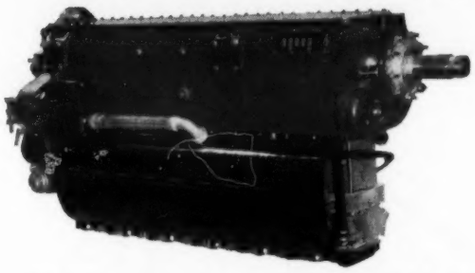

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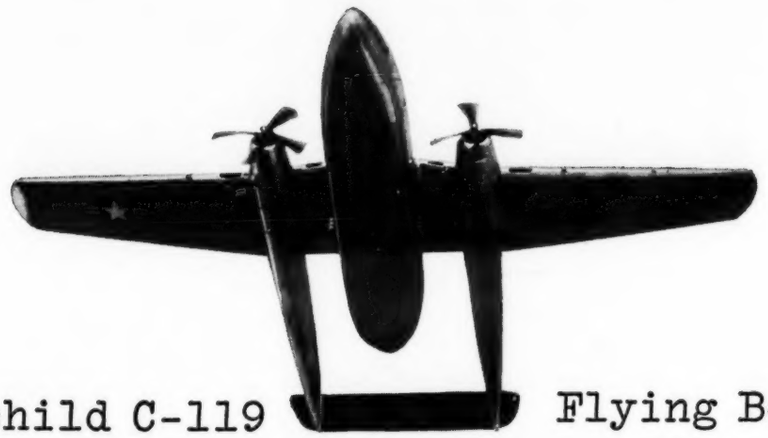
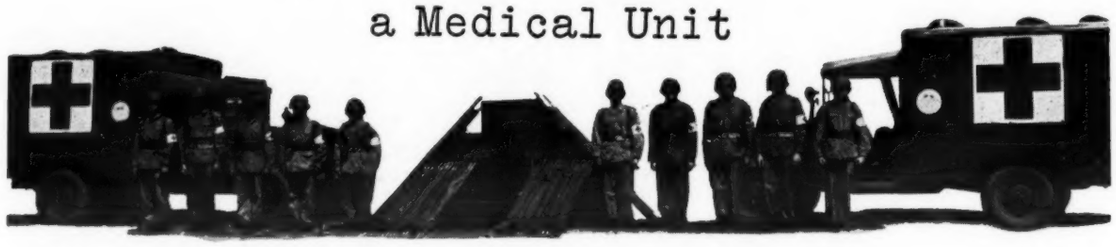


A Fairchild C-119 Flying Boxcar
can easily transport
a Medical Unit



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